RI DEM Class II & III ISDS Designer Exam

2004 Study Guide

This material has been compiled to assist you in your preparation for the Rhode Island Department of Environmental Management Class I ISDS Designers' Examination. This document is intended to be utilized in conjunction with the ISDS Rules and Regulations.

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Part 1 - Introduction

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Examination Date, Time and Location

Date: Thursday, November 19, 2004
Time: Arrive by 8:00 AM

- **Class II & Part 1 of Class III - 8:30 - 12:00**
- **Part 2 of Class III - 1:00 - 4:00**

Location: Room 300, 235 Promenade Street, Providence

What to bring:

- Sharpened pencils
- ISDS Rules and Regulations
- Scale
- Straight Edge
- Calculator
- This guide
- Other materials? - Exam is open book

DEM ISDS Licensing Program Background

Governor's Committee

In 1995, a committee was appointed by the Governor to study the Freshwater Wetlands and ISDS Programs. The Designer statute which mandates the DEM designer licensing program was drafted by this committee to facilitate the following:

Á Streamline Permitting
- Lessen deficiencies, omissions and delays in design and construction
- Increase Accountability
- Focus on failing systems, upgrades, non-point impacts, alternative technologies, large systems

Designer Statute - RIGL 5-56.1

- Classification
- Qualifications/Examinations
- Training & Renewal of Licenses
- Inspections
- Oversight

Class	Qualifications	Authorized Tasks
I	ISDS Installer	Residential system repairs <=900gpd conventional systems and certain alternative technologies
II	PE or PLS	<= 2000 gpd residential <= 900 gpd commercial all Class I + alteration apps + new building apps without critical variances
III	PE	All system designs
IV	Min 9 semester Hours soil science And 2 – 4 years experience	Site/soil evaluations (req'd for all new systems)

Task	Past Practices	Current Practice
Site Suitability	-Wet/dry season WT -DEM verification req'd -No field approval	-Year round WT -Soil Evaluation by specialist -Field verification optional -Field approval allowed
Design	Private Practitioner (PE or PLS)	ISDS licensed designer
Design Review	Detailed review of each application	Level of review based on designer or special conditions
Installation compliance checks	DEM	-ISDS licensed designer -DEM spot checks or case-by-case basis
Certification	ISDS installer	ISDS licensed designer
Conformance	DEM	DEM

Benefits from Licensing

- Lessen seasonal backlog in application processing
- ISDS designs improved
- ISDS performance improved
- Increased accountability on private professional
- Improved public health & environmental protection
- Recognizes specialty of ISDS and facilitates advancement of technology and practice

Activities in Licensing

- Application to take exam
- Exam
- License registration & fee ($100.00)
- License issued - maximum 2 year period
- Continuing education - 8 "classroom hours"
- Renewal of Licenses (December of odd numbered years)

Responsibilities of Designers

- Obtain required site/system data
- Design of sewage disposal system repair
- Submittal of complete and accurate application and plan (see SD 2.01)
- Coordinate installation with owner, installer and builder
- Witness and inspect installations
  - Notify DEM of construction date; at least 24 hr notice
  - Minimum inspection requirements
  - Record and maintain a file (photos, material receipts, etc.)
- Submit Certificate of Construction
- Inform owner of conventional system O & M

Compliance Oversight Process

- Complaints/performance problems
- Preliminary review
- Warning letter
- Review Panel
- Notice of Intent to Suspend or Revoke
- Preliminary hearing
- Notice of Suspension or Revocation
- Appeal/Formal hearing
- Public censure

Driving Directions to DEM

How to Get to DEM's Foundry Offices

235 Promenade Street
Providence, RI 02908-5767

From the South

- Follow Interstate 95 North toward Providence
- Take Exit 22C - Providence Place
- Follow to end of ramp and take a right onto Kinsley/Providence Place
- Go to end, and make a U-shaped turn onto Promenade Street, crossing over river and under Rte. 95
- Take first right onto Holden Street
- Take first right onto Beach Street (between buildings)
- Look for visitor parking spaces

From the North

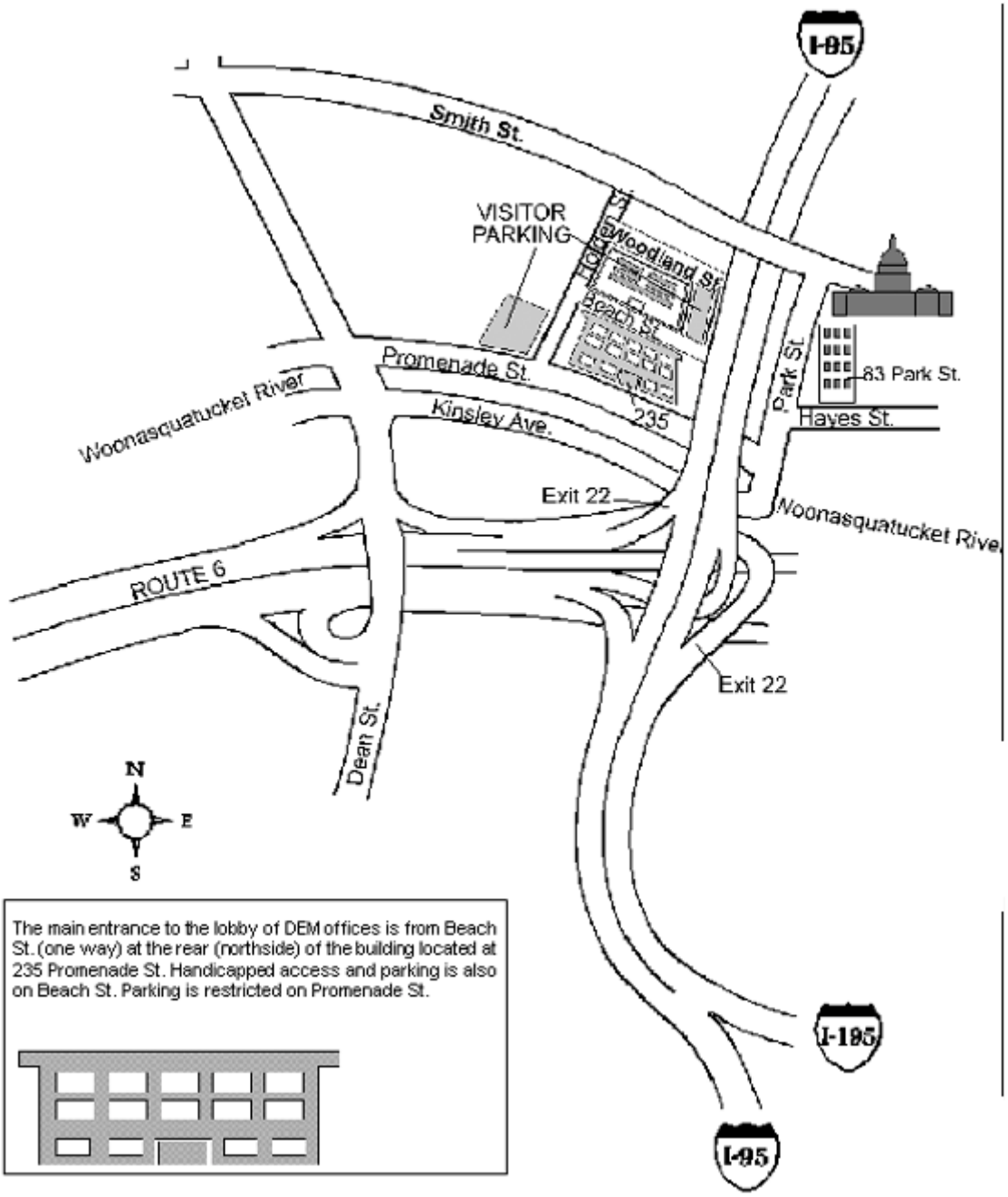
- Follow Route 146 South and/or Interstate 95 South toward Providence
- Take Exit 22C off of 95 South - Providence Place
- At end of ramp go right onto Kinsley Street
- Take left in front of mall garage
- Take immediate left onto Promenade Street
- Take first right onto Holden Street
- Take first right onto Beach Street (between buildings)
- Look for visitor parking spaces

From the West

- Follow Route 6 toward Providence
- Take the Dean Street/Atwells Avenue Exit.
- Turn left at the traffic light at the top of the ramp onto Dean Street
- Go to bottom of the hill and turn right onto Kinsley Avenue/Providence Place
- Go to end, and make a U-shaped turn onto Promenade Street, crossing over river and under Rte. 95
- Take first right onto Holden Street
- Take first right onto Beach Street (between buildings)
- Look for visitor parking spaces

235 Promenade Street is the first building on the right. Visitor parking is in the lot in the next block on the right and off Beach St. (see map for location)

Map of DEM Location



TITLE 5 Businesses and Professions
CHAPTER 5-56.1 Designers of Individual Sewage Disposal Systems

5-56.1-1 Declaration of intent and purpose. – (a) Whereas sewage entering individual sewage disposal systems contains bacteria, viruses, other pathogens and nutrients; and whereas the sewage may also contain hazardous materials, including, but not limited to, cleaning fluids, paints, hobby supplies and other hazardous household chemicals; and whereas improperly designed or defectively installed and failing individual sewage disposal systems may degrade wetlands, groundwater, or surface waters, including drinking water sources; and whereas the public health, the public welfare, and the environment require protection from pollutants emanating from individual sewage disposal systems; the general assembly establishes licensing requirements and responsibilities for persons involved in certain design and installation activities relating to individual sewage disposal systems.

(b) The purpose of this chapter is to establish provisions, qualifications and procedures for licensing persons engaged in the preparation of applications, plans, certifications and specifications for individual sewage disposal systems, also referred to as "ISDSs", for submittal to the department of environmental management.

5-56.1-2 License required. – Beginning one year after issuance of the first designer's license, all plans, applications, evaluations and certifications for the siting, location, design, installation or repair of any individual sewage disposal system submitted to the department of environmental management are prepared by a person possessing an appropriate designer's license issued by the director of the department of environmental management in accordance with rules and regulations promulgated under § 5-56.1-3. The department of environmental management may exempt the repair of individual sewage disposal system from this requirement.

5-56.1-3 Licensing authority. – The department of environmental management, acting through its director and referred to as "the licensing authority", carries out the functions and duties conferred upon it by this chapter. The licensing authority adopts standards, rules and regulations, pursuant to chapter 35 of title 42, for the administration of the licensing program established under this chapter and related activities.

5-56.1-4 Conditions for obtaining a designer's license. – A designer's license is issued to any person who satisfies all the requirements stated below:

(1) A completed application for a designer's license along with a reasonable fee is submitted to the licensing authority; all fees are deposited as general revenues and the amounts appropriated are used for the purpose of administering the water and air protection program.

(2) The applicant for a designer's license is required to pass a written examination, which may include a field component, administered or sanctioned by the licensing authority for the applicable class of license. The test assesses the competency and knowledge of the applicant regarding pertinent subject matter and the application of ISDS regulations.

(3) The licensing authority establishes, through regulations, classes of licenses appropriate to the expertise required for each activity performed by licensed individuals. The licensing authority establishes minimum qualifications, education and experience requirements for each class of license and eligibility requirements for testing. The licensing authority may waive the requirement of a written examination or any portion of it in the case of a person licensed by a federal agency or another state having licensing requirements substantially equivalent to those in Rhode Island.

(4) No person may be granted an exemption to any of the conditions for obtaining a license as provided for in this section on the basis of past experience or "grandfather" rights.

(5) The licensing authority holds an examination at least once per year.

5-56.1-5 License not transferable or assignable. – Designers' licenses are issued to natural persons only and are not transferable or assignable.

5-56.1-6 Expiration and renewal of licenses. – (a) A designers' license is in effect for a period not to exceed three (3) years following the date of issuance.

(b) A license is renewed upon payment of a renewal fee and upon satisfactory completion of any continuing education required by the licensing authority.

5-56.1-7 Responsibilities – Performance and conduct. – (a) A licensed designer performs all studies, measurements, evaluations, investigations, data gathering and other work within his or her licensed area of responsibility required to prepare the applicable submittal for individual sewage disposal systems; non-licensed employees or subordinates of a person possessing a designer's license may assist in the work provided the work is done under the direct supervision of the licensed designer who is responsible for the work and signs any and all required applications, submittals and certifications.

(b) A licensed designer witnesses and inspects the installation of any individual sewage disposal system which he or she designed. The licensing authority may, in accordance with regulation, waive this requirement for good cause, including the designer's death or incapacity.

(c) A licensed designer certifies to the licensing authority that the individual sewage disposal system was installed in conformance with the approved application, plans, specifications, applicable statutes and regulations and that he or she has witnessed and inspected the installation. Upon the certification, the licensed designer is responsible for the installation. The certification is not construed to release the installer from liability. The licensed designer is not responsible for any negligent act or omission of a user of an ISDS which causes damage to the ISDS, including altering of site conditions after certification of installation, failing to properly maintain the ISDS or failing to protect the ISDS from physical disturbance causing damage.

5-56.1-8 Denial, suspension and revocation of licenses – Censure. – (a) The licensing authority may deny, suspend or revoke a designer's license if the person or licensed designer fails to comply with the requirements prescribed in this chapter or any regulation promulgated under this chapter or where the person or licensed designer:

(1) Provided incorrect, incomplete or misleading information in obtaining a designer's license; or

(2) Demonstrated gross or repeated negligence, incompetence or misconduct in the representation of site conditions in an application to the department of environmental management, design of an ISDS, or inspection or certification of an installation of an ISDS; or

(3) Committed a felony involving moral turpitude; or

(4) Failed or neglected to comply with continuing education requirements established by the licensing authority.

(b) An action to suspend or revoke a designer's license pursuant to subsection (a) of this section may not be taken until after the licensed designer has an opportunity to have a hearing before the licensing authority. This hearing is held within thirty (30) days of written notice of intent to suspend or revoke the license.

(c) The licensing authority appoints a review panel consisting of five (5) members at least three (3) of whom are licensed designers not employed by the licensing authority, for the purpose of reviewing and hearing disciplinary actions contemplated under subsection (b) of this section. The review board makes recommendations to the licensing authority to suspend or revoke licenses. All final decisions are made by the licensing authority.

(d) Any person aggrieved by the denial of an application for a license pursuant to § 5-56.1-4 or a denial, suspension or revocation of a license pursuant to this section may request a formal hearing pursuant to § 42-17.1-2(u) which is granted, if requested, in writing by the aggrieved applicant or licensee within ten (10) days of the denial, suspension or revocation.

(e) The licensing authority may publicly censure any licensed designer whose license was suspended or revoked.

5-56.1-9 Penalties. – The penalties for noncompliance with any section of this chapter are the same as stated in §§ 42-17.1-2(v) and 42-17.6-1 et seq., as amended.

Preparation for the Class II and III ISDS Designer Exams

Exam format & required materials

The Class II and III exams are open-book. The format includes multiple choice as well as calculations and one or more design exercises. Materials you **must** bring to the exam:

- Pencils
- Calculator
- Copy of your ISDS Regulations
- Scale

Optional materials you may find helpful

- This study guide
- Reference texts – a general sanitary engineering text that addresses septic systems and a basic hydrology text would likely be the most useful, however the exam may be successfully completed by a knowledgeable applicant without such materials.

Preparation

In preparing, it is appropriate to do the following as applies to the exam for which you are preparing.

- Review SD 25.03 of the ISDS Regulations, which describes:
  - Authority associated with each license class,
  - Eligibility for each of the exams,
  - Content of each of the exams,
  - Expiration, Renewal and Reinstatement of Licenses, and
  - Disciplinary Action
- Familiarize yourself with *all* aspects of the ISDS regulations
- Review and understand basic principles of onsite wastewater treatment
  - Wastewater chemistry (fate and transport of constituents of sanitary sewage)
  - Microbiology (general understanding of organisms present in wastewater and soil)
  - Soils-related concepts (treatment potential)
  - Hydrology
  - Soil physics
- Concepts associated with system failure (identification of failure, types of failure and causes of failure)
- System design
  - Components and their function
  - Sizing
  - Leachfield options
  - Horizontal setbacks
  - Vertical separation distances
  - Pump design
- Site suitability issues

Innovative & Alternative Technologies

The exam will not require memorization of manufacturer specifications for various technologies. Questions will focus on the general principles of the technology and its applicability to certain site conditions.

Responsibility of Designer Beyond Design and Application

Licensure by the ISDS program includes responsibility beyond preparation and submission of applications to the Department. You are strongly urged to read and understand the "designer statute" Title 5 Chapter 56.1 – 9, included in this study guide and sections SD 25 and 27 of the ISDS regulations, which relate to responsibilities beyond design and application submission.

SELECTED REFERENCES

This is a list of typical reference books. The listing is not all-inclusive, nor is it necessary to review these particular books. This is intended as guidance, as to the type of texts you may want to review prior to the exam.

Conventional and Alternative Design of On-site Systems

1. Burks, Bennette D. and Mary M. Minnis. *Onsite Wastewater Treatment Systems,* Madison, Wisconsin: Hograth House, Limited, 1994.

2. Collins, Eldridge. "On-site Wastewater Treatment", *Individual and Small Community Sewage Systems: Proceedings of the Seventh International Symposium in Atlanta, Georgia, November 11-13, 1994*, by The Society for Engineering in Agricultural, Food, and Biological Systems. St. Joseph, Michigan: American Society of Agricultural Engineers, 1994.

3. Laak, Rein. *Wastewater Engineering Design for Unsewered Areas, 2nd Ed.* Lancaster, Pennsylvania: Technomic Publishing Company, Inc. 1986.

4. Perkins, Richard J. *Onsite Wastewater Disposal*. National Environmental Health Association, Lewis Publishers, 1990.

5. United States Environmental Protection Agency. *Design Manual*: *Onsite Wastewater Treatment and Disposal Systems.* Washington, D.C.: U.S. Government Printing Office, 1980.

6. United States Environmental Protection Agency. *Onsite Wastewater Treatment Systems Manual.* Washington, D.C.: U.S. Government Printing Office, 2002.

   This document is available online, as is ordering information, via a link for the DEM website. To access the link from DEM home (http://www.state.ri.us/dem), select "Programs", then "ISDS", then the link to the "Installer and Designers Licensing Program" from the left side of the screen, the link is on the left side of the screen and is titled "2002 EPA Design Manual".

Wastewater Engineering

7. Crites, Ron and George Tchobanglous. *Small and Decentralized Wastewater Management Systems.* The McGraw Hill Companies, Inc. 1998.

8. Salvato, Joseph A. *Environmental Engineering and Sanitation, 4th Edition.* New York: A Wiley-Interscience Publication. 1992.

Groundwater

9. Freeze, Allen R. and John A. Cherry. *Groundwater.* Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1979.

10. Matthess, Georg. *Properties of Groundwater.* New York: A Wiley-Interscience Publication. 1982.

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Part 2 – Sample Exam Questions

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Dose Volume 13

Sample Site for Which ISDS is to be Designed 21

Sample Site Plan With all Necessary Features Depicted 22

Sample Construction Notes and Invert Schedule 23

Sample Construction Notes with Required Dimensions and Elevations Provided 24

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Example Site Plan of System Requiring Repair 26

Example Site Plan With Repair Design 27

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CLASS II – ISDS Designer Licensing Exam

(Part 1 of the Class III Exam)

Point Distribution

20 points **SECTION I** – *ISDS Regulations*
40 questions – 1/2 point each

25 points **SECTION II** – *Principles of Design of On-Site Sewage Systems*
25 questions – 1 point each

15 points **SECTION III –** *Analysis of ISDS Failure*
15 questions – 1 point each

40 points **SECTION IV** – *Design and Construction of an ISDS, with consideration to soil types and related constraints.*

PART A 10 points – Pump design

PART B 5 Points – Complete ISDS Application
25 points – ISDS Design

A passing grade for this part of the exam is 70%.

Class III ISDS Designer Licensing Exam

(Part 2 of the Class III Exam)

20 points **SECTION V** – *Advanced Wastewater Treatment Technologies*
10 questions - 2 points each

30 points **SECTION VI** – *Groundwater Hydrology & Resource Protection*
10 questions - 3 points each

50 points **SECTION VII** – *Understanding of Additional Applicable State Regulations, Advanced Treatment Technologies and Commercial Wastewater Treatment*
50 points total; 25 points for commercial design, and 25 points for variance design.

A passing grade for this part of the exam is 70%.

Sample Exam Questions

Section I - ISDS Regulations

A leach field must be at least _____ feet from a subsurface drain.

a) 15
b) 20
c) 25
d) 30

An impervious layer within a soil profile can be:

a) Rotten rock
b) Decomposed shale
c) Ledge
d) All of the above
e) None of the above

A client has a cesspool for an ISDS. He/she states that a second floor addition will contain an additional 2 bedrooms. What type of application would this be considered?

a) Alteration
b) Repair
c) New Building Construction
d) Other

Can a Class II designer submit a Subdivision Suitability Determination?

a) Yes
b) No

A Class I, II and III designer is required to do the following:

a) Inspect and make measurements of the exposed bottom of the excavation for the leachfield.
b) Record and list all materials used, their source, and the dates delivered to the site.
c) Notify the Department during hours of operation at least 24 hours prior to the installation of any ISDS.
d) All of the above.
e) a & b only.

Section II - Principles of Onsite Sewage Treatment and Disposal

The clogging layer is formed at the _____.

a) Edge of the perforated pipe and stone.
b) Top of the trench and or chamber.
c) Point of infiltration into the soil.
d) None of the above.

Briefly define both of the following terms.

Anaerobic conditions _____

Aerobic conditions _____

Section III – Analysis of Failure

Leachfield failure may be caused by _____.

a) Scouring of solids from the septic tank.
b) Overuse and excessive hydraulic loading.
c) Smearing of the bottom area of the leachfield.
d) All of the above.

EXAMPLE: DESIGN A TRENCH SYSTEM

Given:
- Soil Category 5
- 3 Bedroom

Design a trench system

1) From the table in SD 3.01 “Minimum Design Requirements for Sewage Flow” sewage flow for a Single family residence (2 persons per bedroom) X 75 gallons per person per day = 150 G/BR

   3 bedrooms X 150 G/BR = 450 Gallons per day maximum daily flow for the residence

2) From the table of percolation rate equivalents, at the end of in section SD 26.01:
   Soil Category 5 is assigned a percolation rate of 10 minutes per inch (mpi).

3) Minimum leaching area - From the table in SD 10.07: for a percolation rate of 10 mpi, trenches require 165 square feet (sf) per bedroom.

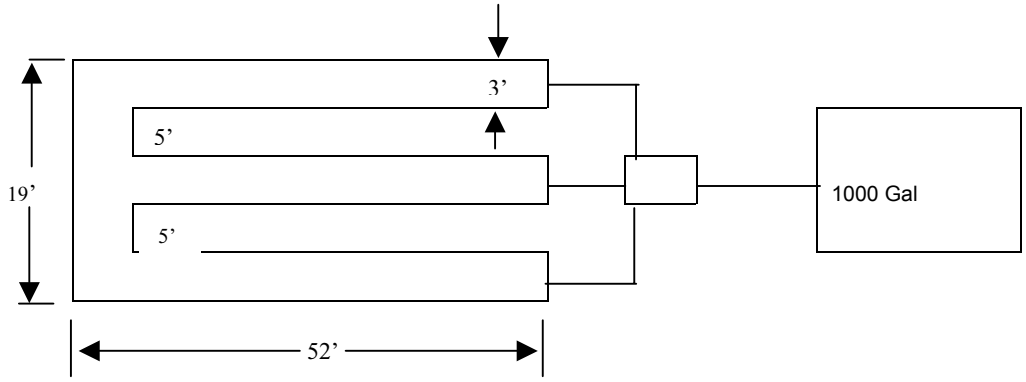
   3 bedrooms X 165 sf = 495 sf of leaching area required

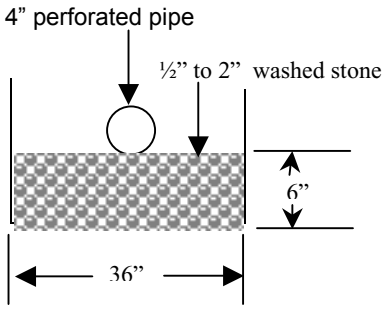
4) Leaching area - From SD 11.01(b): 6 inches of stone beneath the pipe invert, 36’ in. wide trench, leaching area allowed per lineal foot of trench is 3.0 sq ft./ft

   495 sf leaching area ə 3 sf/ft = 165 linear feet of trench

   Assume 3 trenches

   165 ə 3 = 51.66 (3 trenches of 52‘)





EXAMPLE: DESIGN A FLOW DIFFUSOR SYSTEM

Given:

- Soil Category 5
- 3 Bedroom

Design a septic system with flow diffusers.

---

1) From the table in SD 3.01 “Minimum Design Requirements for Sewage Flow” sewage flow for a Single family residence (2 persons per bedroom) X 75 gallons per person per day = 150 G/BR

   3 bedrooms X 150 G/BR = 450 gallons per day

2) From the table of percolation rate equivalents, at the end of in section SD 26.01:
   Soil Category 5 is assigned a percolation rate of 10 minutes per inch (mpi).

3) Minimum leaching area from the table in SD 10.07: for a percolation rate of 10, trenches require 165 square feet (sf) per bedroom.

   3 bedrooms X 165 sf = 495 sf of leaching area required

4) Leaching area - From SD 13.02 table, with 12 inches of stone on sides and under:

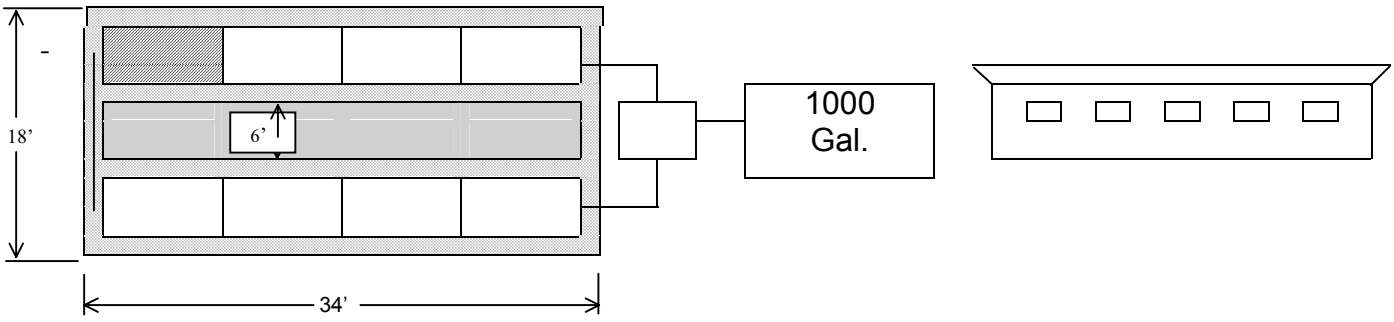
   Each end unit effective leaching area = 78 Sq. Ft./Unit

   Each interior unit effective leaching area = 64 Sq. Ft./Unit

5) Assume 2 trenches

   495 Sq. Ft. – 312 Sq. Ft. (leaching area for 4 end units) = 183 Sq. Ft.

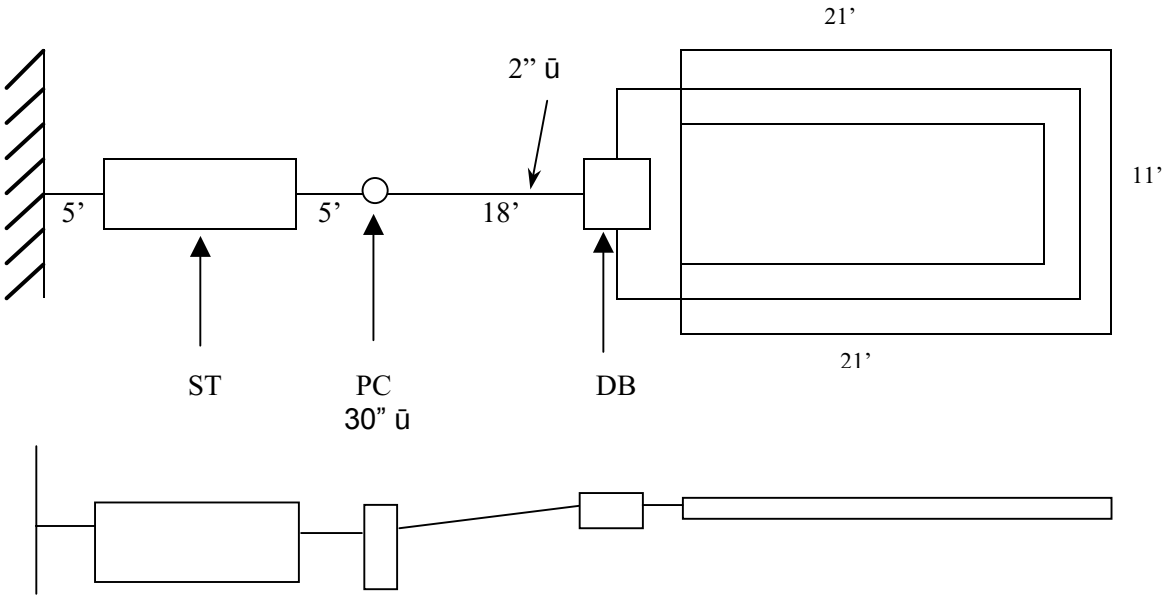
   183 Sq. Ft. э 64 Sq. Ft./ Interior Unit = 2.86 Therefore, use two trenches, one with three units and one with 4, or two trenches each with four units.



Legend	
	Stone
	Soil
	Optional unit

Sample Pump Calculations

Given the following information complete the pump calculation for a 3 bedroom dwelling



- Assume 1 90˚ elbow in pump chamber assembly
- Assume pump is 2” off the bottom of the pump chamber and use the bottom of the pump as the pump “off” elevation and for static head calculations.

Inverts:	House	23.10
	ST “in”	23.05
	ST “out”	22.80
	PC “in”	22.75
	PC bottom	19.50
	PC “out”	23.00
	DB “in”	27.50
	DB “out”	27.33
	Field	27.33
	Pump off	19.67

Required tables are on following pages

A. Find leachfield volume

4” pipe ⟶ r = 2” L = (2 X 21) + 5 = 47’

$V = \pi r^2 L$

$V = \pi (2/12)^2 (47) =$ **4.1ft ^{3}**

Dose 60% to 75% of leachfield volume
0.60 X 4.1 = 2.46 ft^3
or
0.75 X 4.1 = 3.08 ft^3

Use 2.46 ft^3

2.46 ft^3 X (7.481 GAL/1.0 ft^3) = **18.40 Gal**

B. Find required draw in pump chamber
Draw = (dose volume / pump chamber area)
2.46 ft^3 / (` (15/12) ^{2}) = 0.501 ft X (12 in / 1 ft) = **6 in**

C. Static Head Loss
D-box "in" = 27.50
Pump "off" = 19.67
7.83 ft

D. Find Equivalent Pipe Length

Actual length + Fittings (from Source 1, use 90° elbow)

Actual Length = 18 ft
Fittings (source1)
90° elbow = 5 ft
23 ft

E. System Curve

Q GPM	Pipe Length	X	Head Loss (per 100 ft) from Source 2	=	Dynamic Loss	+	Static Loss	=	Total Head Loss (ft)
60	23		4.83 / 100		1.11		7.83		8.94
70	23		6.43 / 100		1.48		7.83		9.31
75	23		7.30 / 100		1.68		7.83		9.51
80	23		8.23 / 100		1.89		7.83		9.72

Plot Q vs Head Loss (*chart on following page*)

F. Pump Capacity

At 9.0 ft of head the pump capacity is 65 GPM

Pump runs for:

Leachfield volume / pump capacity

18.4 Gal / 65 Gal/min = 0.283 min = 16.98 sec, **use 17 sec**

G. Pump Setting

Pump off = 19.67
Pump on = 20.17 (using 6” draw down)

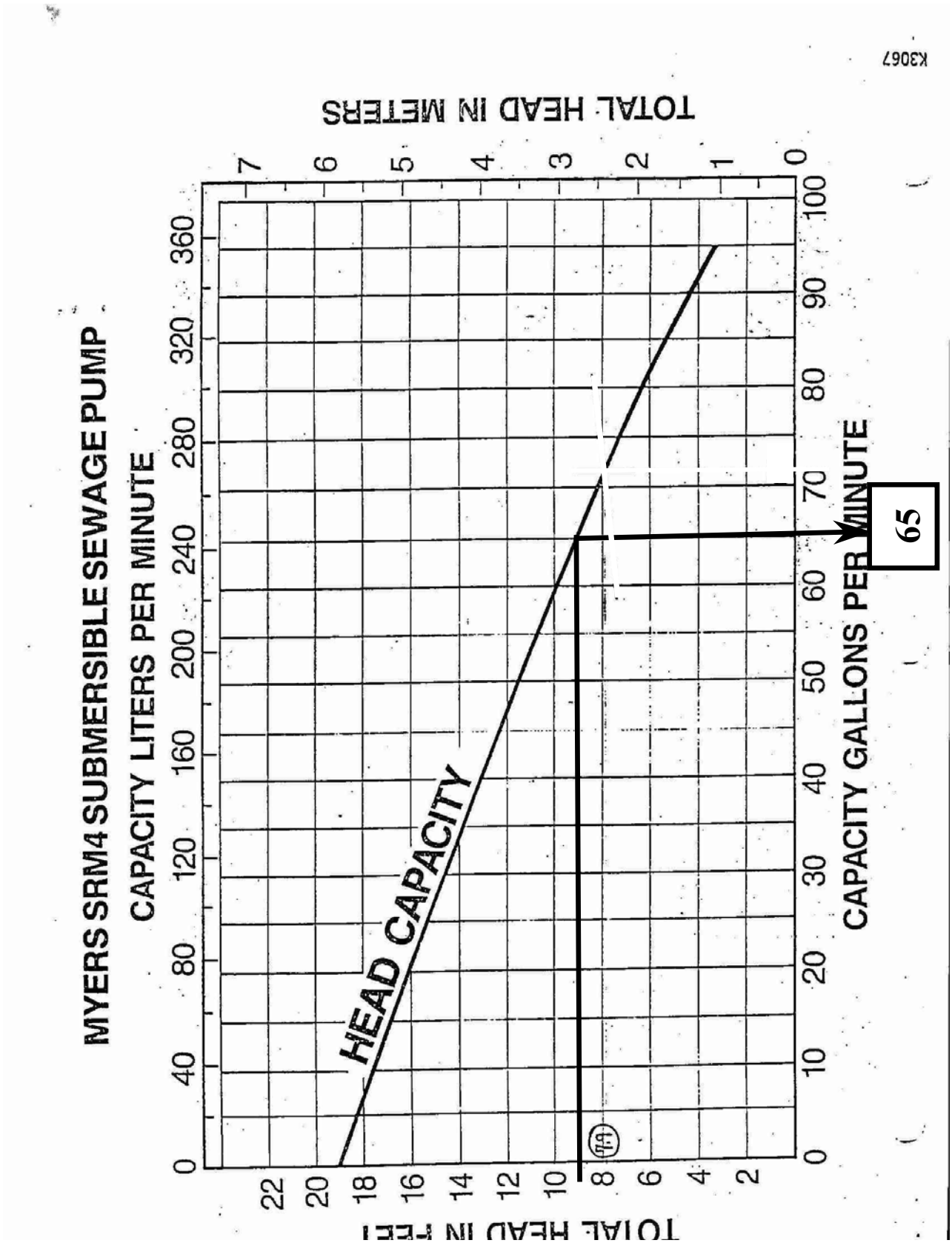
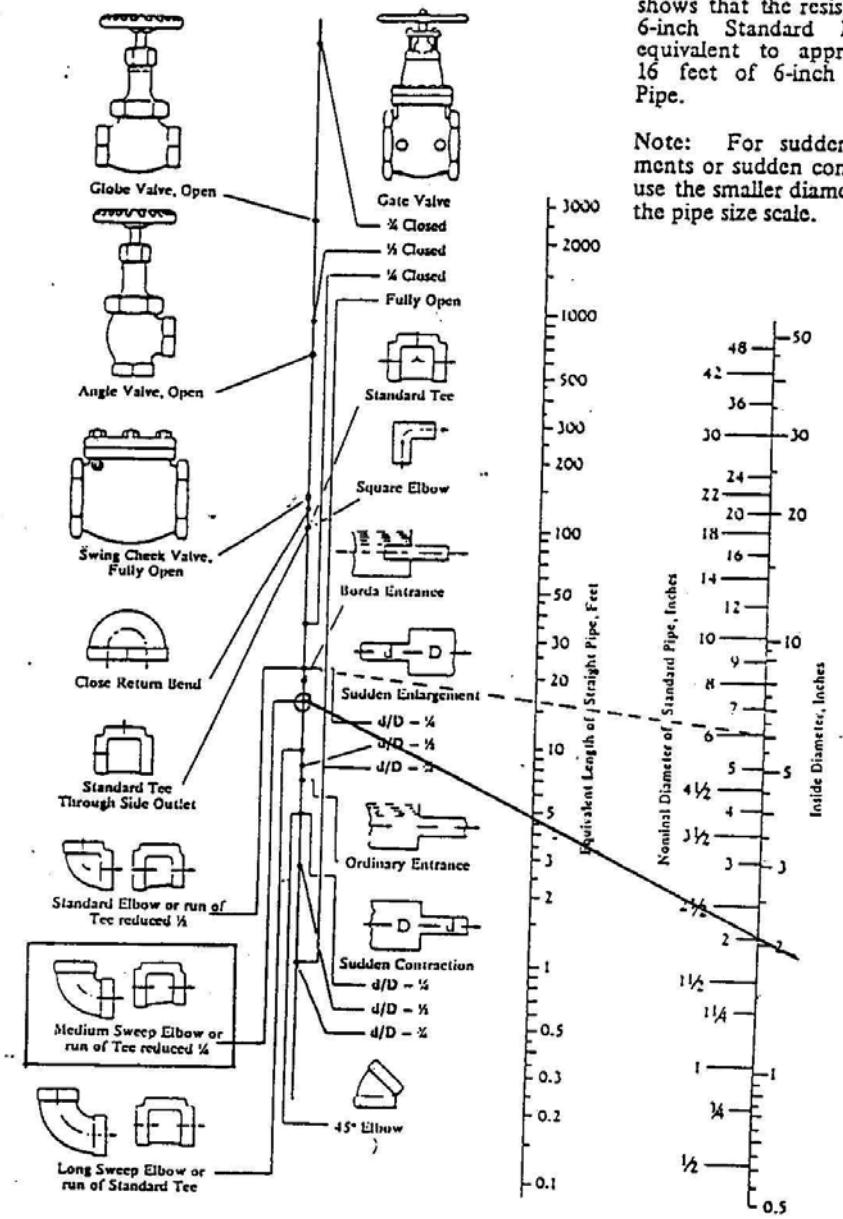

MYERS SRM4 SUBMERSIBLE SEWAGE PUMP
CAPACITY LITERS PER MINUTE
CAPACITY GALLONS PER MINUTE
TOTAL HEAD IN METERS
TOTAL HEAD IN FEET
HEAD CAPACITY
65
K3067

FIGURE 37 – RESISTANCE OF VALVES AND FITTINGS TO FLOW OF FLUIDS

Note: Head loss through check valves varies with types manufactured. Consult manufacturer for correct values.



Example: The dotted line shows that the resistance of a 6-inch Standard Elbow is equivalent to approximately 16 feet of 6-inch Standard Pipe.

Note: For sudden enlargements or sudden contractions, use the smaller diameter, d, on the pipe size scale.

SOURCE 1

TABLE 42 – FLOW FRICTION LOSS, ASTM D2241 PVC PIPE

1½" IPS (ASTM D2241)

	SDR 26			SDR 21		
Flow Gals./Min.	Velocity Ft./Sec.	Loss of Head Ft./100 Ft.	Press. Drop PSI/100 Ft.	Velocity Ft./Sec.	Loss of Head Ft./100 Ft.	Press. Drop PSI/100 Ft.
2	0.27	0.024	0.010	0.28	0.027	0.012
5	0.68	0.13	0.057	0.71	0.15	0.063
7	0.95	0.25	0.11	0.99	0.27	0.12
10	1.36	0.48	0.21	1.41	0.52	0.23
15	2.04	1.01	0.44	2.12	1.11	0.48
20	2.72	1.72	0.74	2.83	1.89	0.82
25	3.40	2.59	1.12	3.53	2.86	1.24
30	4.08	3.64	1.58	4.24	4.01	1.74
35	4.76	4.84	2.10	4.95	5.33	2.31
40	5.43	6.20	2.69	5.65	6.82	2.96
45	6.11	7.71	3.34	6.36	8.49	3.68
50	6.79	9.37	4.06	7.07	10.31	4.47
60	8.15	13.13	5.69	8.48	14.46	6.27
70	9.51	17.46	7.57	9.89	19.23	8.34
75	10.19	19.84	8.60	10.60	21.85	9.47

2" IPS (ASTM D2241)

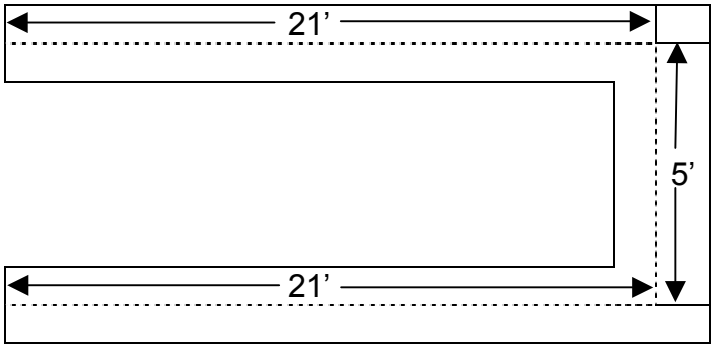
	SDR 26			SDR 21		
Flow Gals./Min.	Velocity Ft./Sec.	Loss of Head Ft./100 Ft.	Press. Drop PSI/100 Ft.	Velocity Ft./Sec.	Loss of Head Ft./100 Ft.	Press. Drop PSI/100 Ft.
2	0.17	0.0080	0.0035	0.18	0.0089	0.0039
5	0.43	0.044	0.019	0.45	0.048	0.021
7	0.61	0.082	0.035	0.63	0.090	0.039
10	0.87	0.16	0.069	0.90	0.18	0.076
15	1.30	0.34	0.15	1.35	0.37	0.16
20	1.73	0.57	0.25	1.80	0.63	0.27
25	2.16	0.86	0.37	2.25	0.96	0.41
30	2.60	1.21	0.53	2.70	1.34	0.58
35	3.03	1.61	0.70	3.15	1.78	0.77
40	3.46	2.06	0.89	3.61	2.28	0.99
45	3.89	2.57	1.11	4.06	2.84	1.23
50	4.33	3.12	1.35	4.51	3.45	1.49
60	5.19	4.37	1.90	5.41	4.83	2.09
70	6.06	5.82	2.52	6.31	6.43	2.79
75	6.49	6.61	2.87	6.76	7.30	3.17
80	6.92	7.45	3.23	7.21	8.23	3.57
90	7.79	9.27	4.02	8.11	10.24	4.44
100	8.65	11.26	4.88	9.01	12.44	5.39

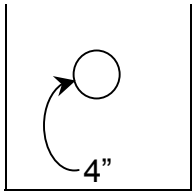
NOTE: Table is based on Hazen-Williams Equations 80, 81, 82 and 82. C = 150

SOURCE 2

Dose Volume

Trenches

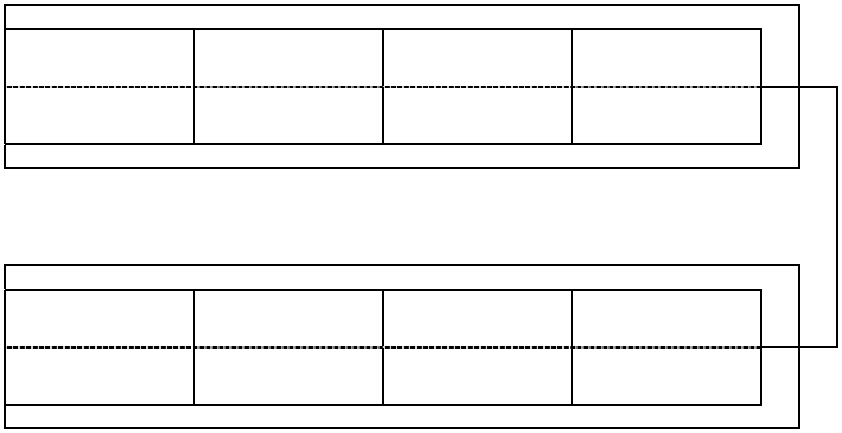


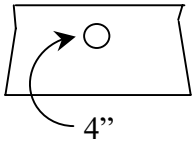


Pipe Length = (2 X 21) + 5 = 47 ft.
Pipe radius = 2”
V = ` r ^{2} L
V = ` (2/12)^2 (47) = 4.102 ft^3 ***or***
4.102 ft^3 X 7.48 Gal/ft^3 = 30.68 Gal

60% = 18.4 Gal
75% = 23 Gal

Flow Diffusors





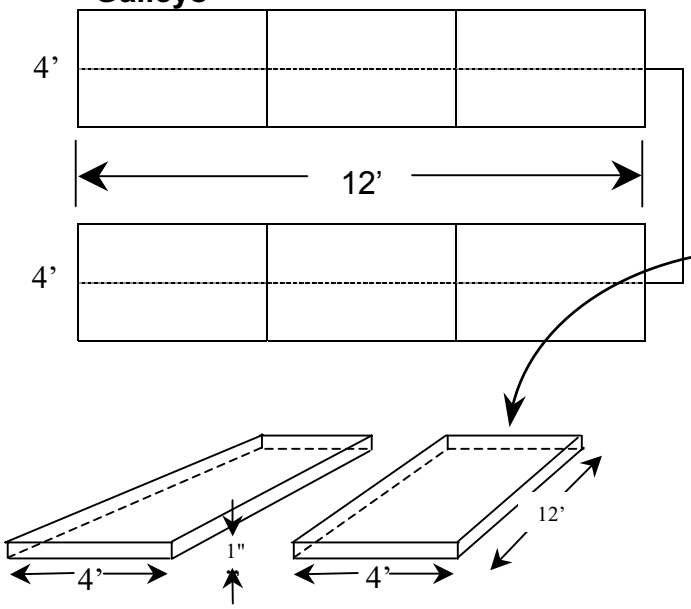
Pipe Length = 8 feet for each flow diffusor
8 X 8 = 64 ft

Pipe radius = 2”
V = ` r ^{2} L

V = ` (2/12)^2 (64) = 5.585 ft^3 ***or***
5.585 ft^3 X 7.481 Gal/ft^3 = 41.78 Gal

60% = 25.07 Gal
75% = 31.34 Gal

Galleys



No Pipe! Must use bottom area of galleys

Bottom area = 12 X 4 = 48
+ 12 X 4 = 48
96 SF

Dose to a one inch depth

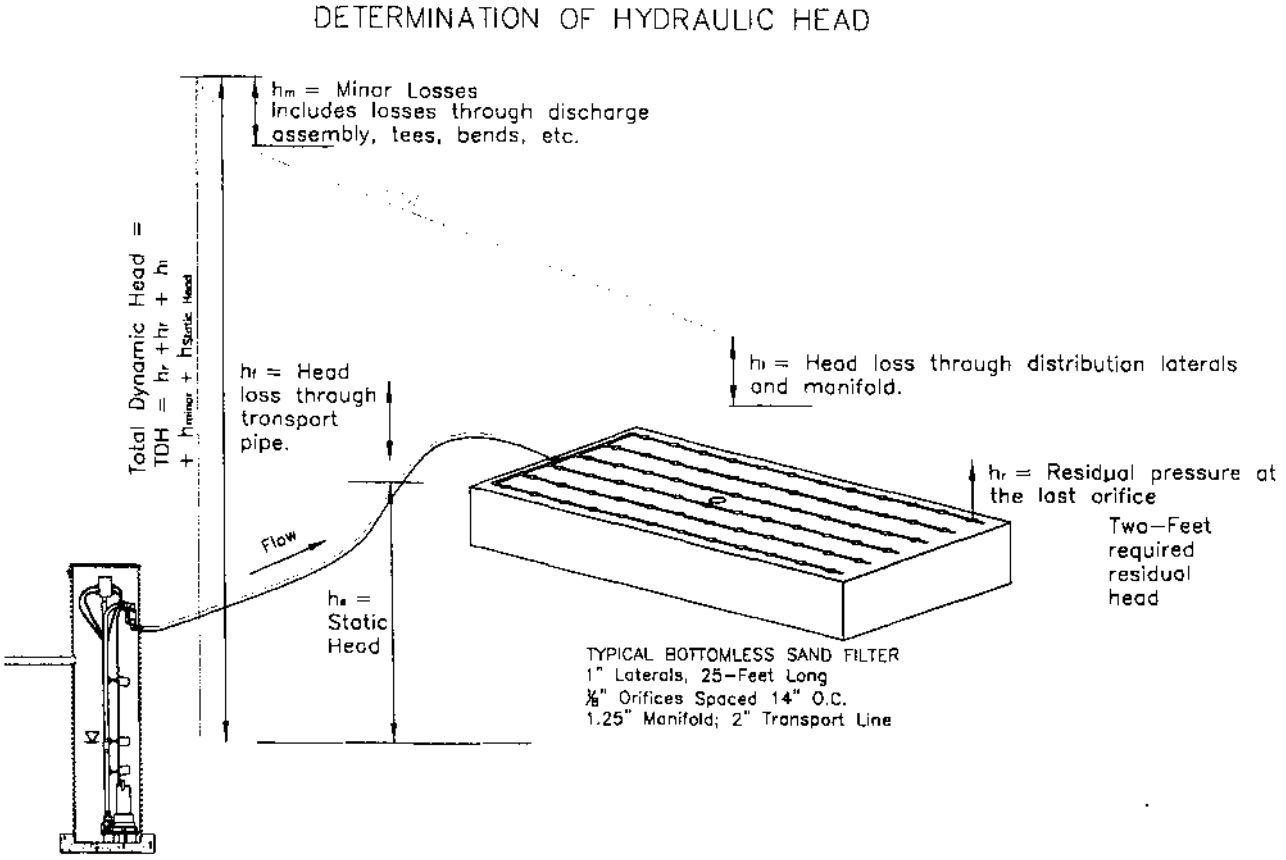
V = (1/12)(96) = 8.00 FT^3
or

8 X 7.481 = 59.85 Gallons

60% = 35.91 Gallons
70% = 44.89 Gallons

Bottomless Sand Filters

Determining hydraulic head, pumping considerations and pump selection



Step 1: Determine Total Flow Rate

A. Set the discharge rate for each orifice. Use the orifice equation or the limit in the state guidelines.

$Qo = 12.4d^2h^{0.5}$

where:

Qo = gpm / orifice

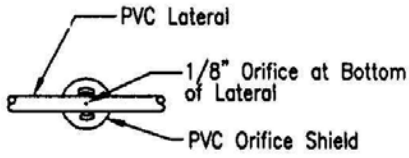
d = size of orifice (inches)

h = required residual head (ft)

Example

d = ⅛"

h = 2'



$Qo = 12.4d^2h^{0.5}$ = 0.27 gpm /orifice

B. Estimate total flow by multiplying the flow for each orifice by the number of orifices.

$Qt = (\#\ orfices / lateral) \times (\#\ laterals) \times Qo$

where:

Qo = gpm / orifice

Example

4 Laterals

25 Feet Long

15" Spacing

25' / 1.25' = 20 orifices / lateral

20 x 4 = 80 orifices total

Qo = 0.27 gpm /orifice x 80 orifices = 21.6 gpm

Step 2: Use the Total Flow Rate Determined in Step 1 to Determine Total Dynamic Head Losses

A. Determine the Static Head = h_s = Difference in elevation between the manifold and liquid level in the pump chamber

Example

Elevation of water level = 95.0
Elevation of manifold = 100.0
h_s = 100.0 - 95.0 = 5'

B. Determine Head Loss through Transport Pipe = h_f = Friction losses which can be calculated using Hazen-Williams Formula.

$$h_f = \frac{(4.27\ L)\ (Q/C)^{1.85}}{D^{4.87}}$$

where:
h_f = Friction Loss
C = Hazen-William Coefficient
D = Pipe Diameter
L = Pipe Length

where:
Q = 21.8 gpm
C = 150 for 2" PVC
D = 1.25"
L = 40 '

$$h_f = \frac{(4.27 * 40)\ (21.8/150)^{1.85}}{1.25^{4.87}} = 1.6 \text{ feet}$$

C. Determine residual head which is required by state to ensure scouring and proper pressure distribution.

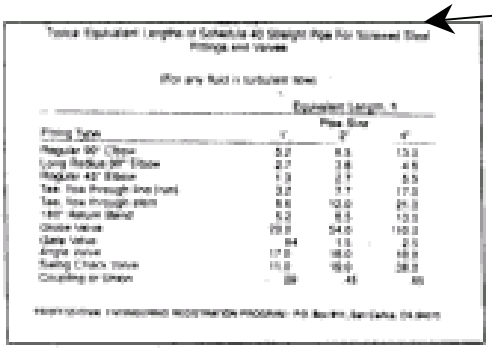
Example: Bottomless Sand Filter = 2.0 Feet

Step 2: Use the Total Flow Rate Determined in Step 1 to Determine Total Dynamic Head Losses

D. Determine Losses Through the Laterals = h_l = Use a pump calculation program or follow the procedure on the following page which outlines an iterative process for calculating loss through consecutive lateral orifices.

Example: 0.5 Feet

E. Determine Minor Losses: Use manufacture's determined values for equivalent length for distribution assemblies or through certain fittings.



From table

$$H_f = \frac{(4.27\ L)\ (Q/C)^{1.85}}{D^{4.87}}$$

where:
H_f = Friction Loss
C = Hazen-William Coefficient
D = Pipe Diameter
L = Equivalent Length

where:
L = 8.5' for 90 Elbow

Q = 21.6 gpm
C = 150 for 2" PVC
D = 2"
L = 8.5'

$$h_f = \frac{(4.27 * 8.5\ )\ (21.8\ /150)^{1.85}}{2^{4.87}} = 0.03 \text{ feet}$$

F. Add Each Component of Head to Determine the Total Dynamic Head

5' + 1.3' +2.0' + 0.5' + 0.03' = 8.85 Feet of Head

METHOD FOR DETERMINING TOTAL HEADLOSS IN A PRESSURE LATERAL

(A) First calculate the discharge rate at orifice no. 1 using the following orifice equation:

$$Q_o = 12.38d^2\sqrt{h}$$

Where; Q_o = GPM
d = diameter of orifice in inches
h = feet of pressure head at the orifice

(B) Next, calculate the actual headloss in each segment, in succession, from the end orifice (orifice no. 1) to the final orifice (orifice no. 16) using the following headloss equation. The segment headloss is then added to the preceding pressure head (ie. h2 = h1 + hf1... etc).

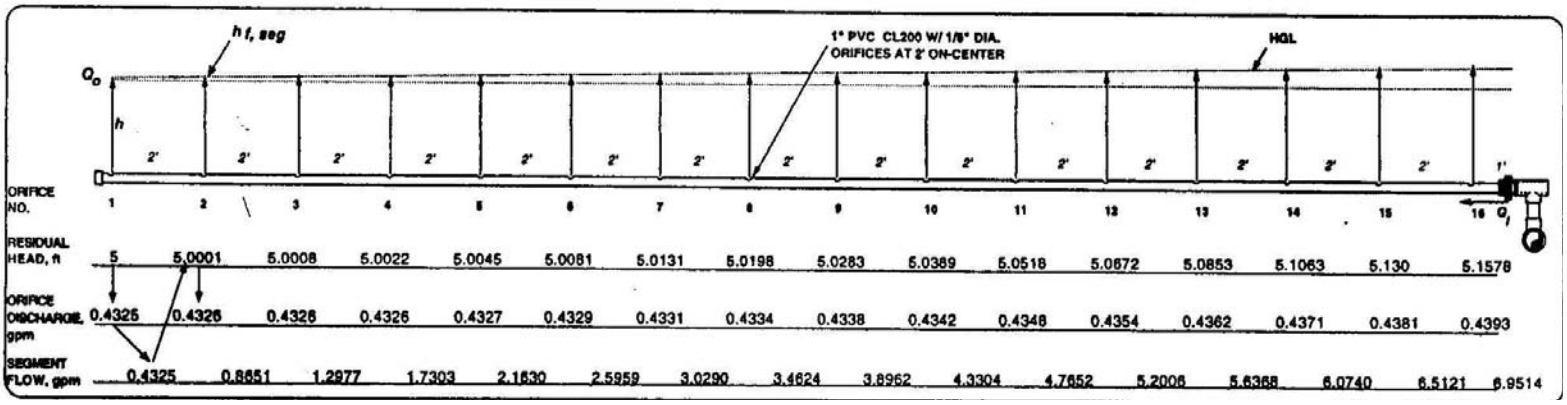
$$h_{f,seg} = \frac{4.727 L_{seg}\left(\frac{Q_{seg}}{449C}\right)^{1.85}}{\left(\frac{d}{12}\right)^{4.87}} = 0.000995\frac{L_{seg}}{d^{4.87}}Q^{1.85}$$

Where; Q_{seg} = the summation of orifice discharges following the segment (ie. Qo1 + Qo2 + Qo3...etc.) in GPM
L_{seg} = the segment length between orifices, in feet
d = the inside diameter of the PVC line, in inches
C = 150 (Hazen-Williams coefficient)

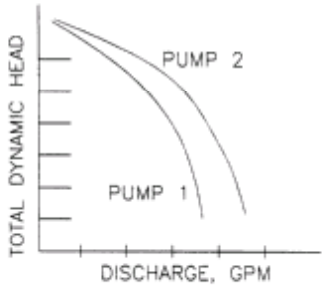
(C) Using the diagram below as an example:

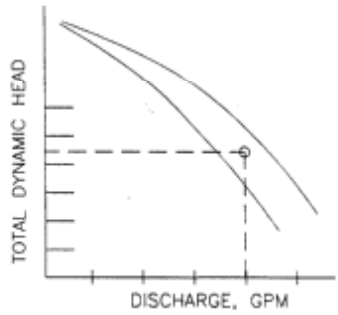
1. Assuming 5' of pressure at orifice #1:
   $Q = 12.38d^2\sqrt{5} = 12.38(0.125)^2\sqrt{5} = 0.4325$ GPM
   0.4325 GPM flows in the segment of pipe between orifice #2 and orifice #1.
2. The headloss in the segment between orifice #2 and orifice #1 is given by:
   $h_{f,seg} = 0.000856(Q_{seg})^{1.85} = 0.000856(0.4325)^{1.85} = 0.00018'$
3. The pressure at orifice #2 is 5 + 0.00018 = 5.00018' and the flow is 0.4326.
4. The flow from orifice #3 to orifice #2 is 0.4325 + 0.4326 = 0.8651 GPM. The headloss in the segment between orifices #3 and #2 is
   $h_{f,seg} = 0.000856(0.8651)^{1.85} = 0.00066'$
6. The pressure at orifice #3 is 5.00018 + 0.00066 = 5.00084' etc..

(D) When the flow in an upstream orifice exceeds flow in orifice #1 by 10%, the maximum length of lateral has been reached.



Step 3: Select a Pump Using Manufacturers Discharge-Head Curves





Plot:
Estimated Required Discharge from Step 1
Total Dynamic Head from Step 2 (F)

8.85 Feet of Head
21.8 gpm Flow Rate

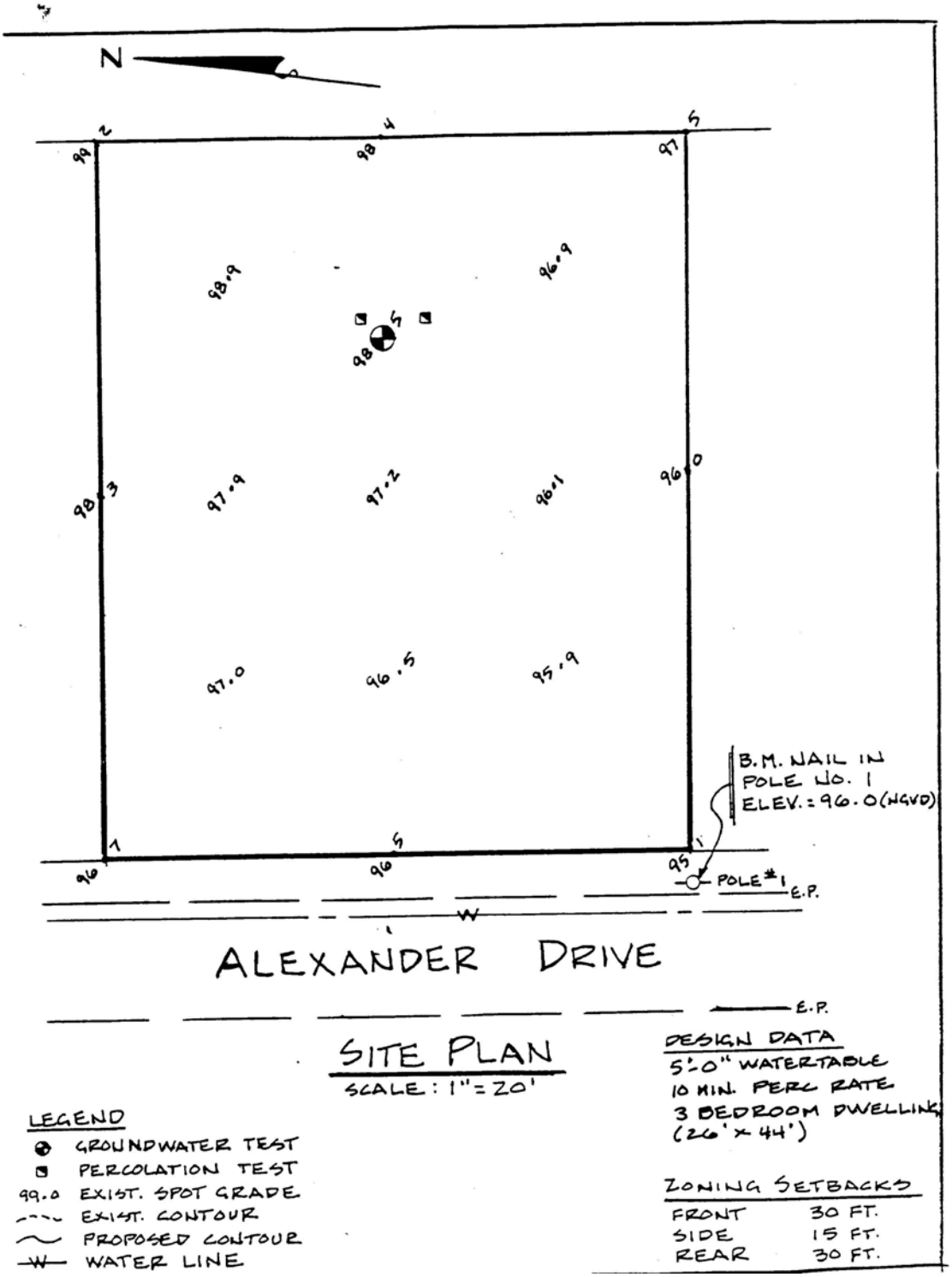
Select Pump 2

General Pump Considerations

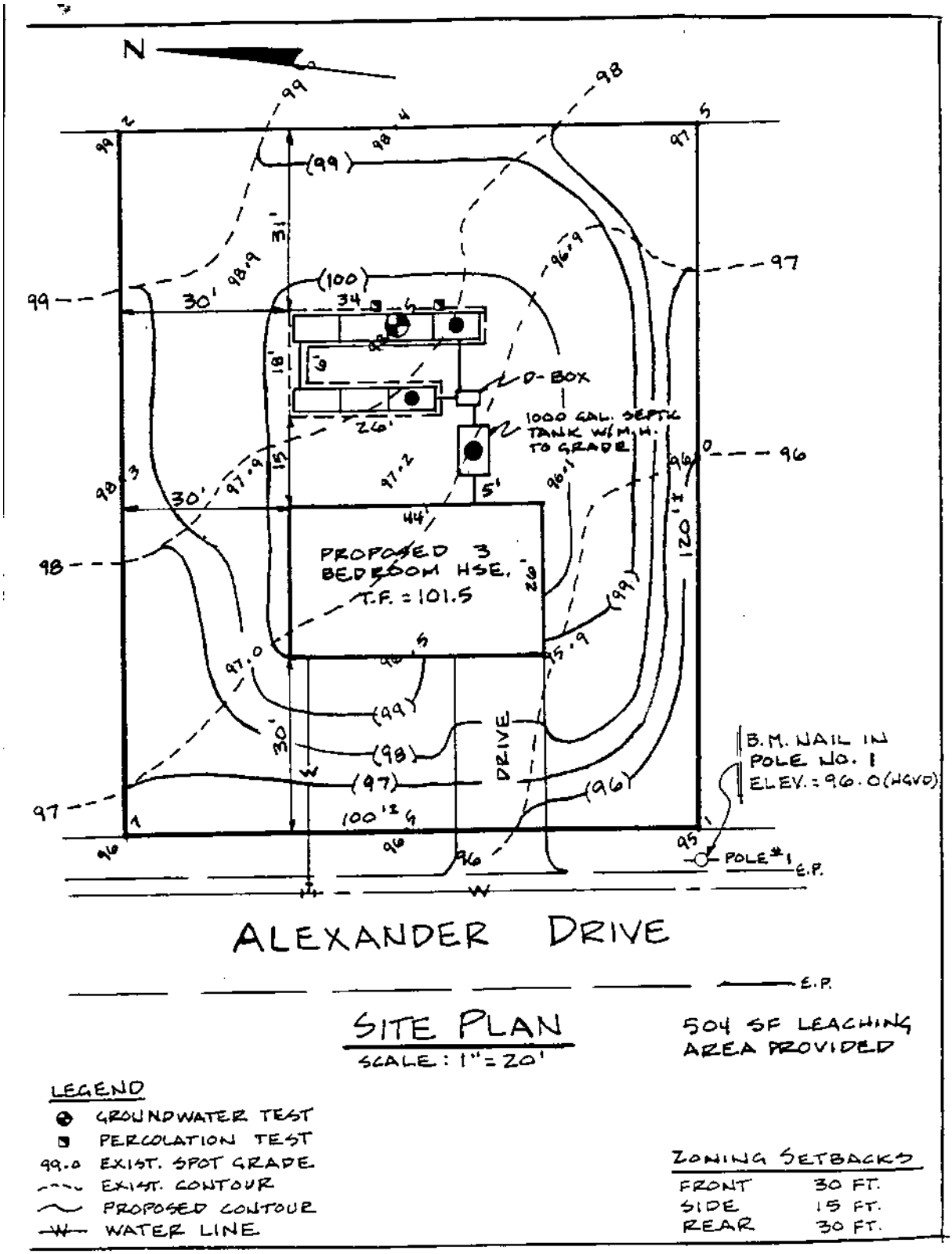
- Free Drainback to Either the Pump Basin or Field Should Be Provided To Prevent Freezing of Water in the Transport Line. Check Valves Shall Not Be Used If Drainback Is Directed Towards the Basin.
- Check Valves Shall Be Used If Flow Back Through the Discharge Must Be Prevented (i.e. When Using Duplex Pumps With a Common Assembly).
- An Anti-Siphon Device Shall Be Used When Pumping Downhill.
- Weephole with Check Valve + Drainback

Sample Site for Which ISDS is to be Designed

See next page for sample site plan with all necessary features depicted.



Sample Site Plan With all Necessary Features Depicted



Sample Construction Notes and Invert Schedule

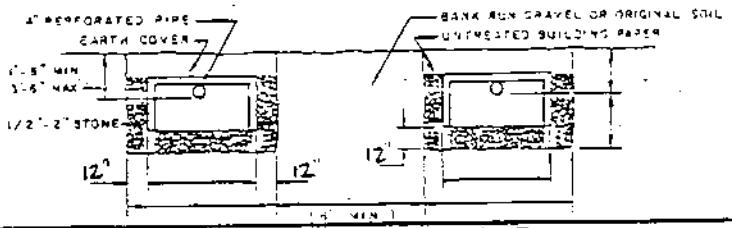
See next page for this form with all required dimensions and elevations provided.

CONSTRUCTION NOTES

1. MAINTAIN INVERT ELEVATION _____ FOR 25 FT. AROUND SYSTEM.
2. STRIP ALL TOPSOIL & SUBSOIL TO A _____ PERIMETER AROUND SYSTEM AND BACKFILL WITH CLEAN BANKRUN GRAVEL TO ELEVATION _____.
3. CLEAR ALL TREES AND STUMPS WITHIN 10 FT. OF SYSTEM.
4. NO EXISTING OR PROPOSED WELLS WITHIN 200 FT. OF SYSTEM OTHER THAN SPECIFIED ON PLAN.
5. NO EXISTING OR PROPOSED SEPTIC SYSTEMS WITHIN 100 FT. OF PROPOSED WELL
6. PROPOSED WELL TO BE INSTALLED 100 FT. MINIMUM FROM ANY LEACHING FIELD
7. INSTALL SCHEDULE 40 PVC PIPE FROM FOUNDATION TO SEPTIC TANK (4" MIN).
8. PROPOSED TOP OF FOUNDATION ELEVATION IS DIRECTLY RELATED TO PROPER INSTALLATION AND FUNCTIONING OF LEACH FIELD AND SHOULD NOT BE CHANGED WITHOUT FIRST CONSULTING ENGINEER.
9. ALL DESIGN, CONSTRUCTION, AND MAINTENANCE REQUIREMENTS TO BE IN CONFORMANCE WITH THE "RULES AND REGULATIONS ESTABLISHING MINIMUM STANDARDS RELATING TO LOCATION, DESIGN, CONSTRUCTION AND MAINTENANCE OF INDIVIDUAL SEWAGE DISPOSAL SYSTEMS, STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS, DEPARTMENT OF ENVIRONMENTAL MANAGEMENT" AS AMENDED.
10. NO SUBSURFACE DRAINAGE TO BE INSTALLED WITHIN 25 FT. OF PROPOSED SYSTEM.
11. MANHOLE ON SEPTIC TANK TO BE BROUGHT TO FINISH GRADE.
12. DISTRIBUTION PIPES SHALL BE SCHEDULE SDR 35 OR EQUAL (4" MIN.).
13. DISTRIBUTION BOX SHALL BE CAPABLE OF WITHSTANDING H20 WHEEL LOADS.
14. PROVIDE CHAMBERS WITH INLETS AT 25 FT. INTERVALS.
15. CHAMBERS TO BE PERFORATED PRECAST CONCRETE, STONE, BRICK, OR CEMENT BLOCK, LAID DRY WITH OPEN JOINTS.
16. NO EXISTING OR PROPOSED PUBLIC WELLS WITHIN 500 FT. OF SYSTEM OTHER THAN SPECIFIED ON PLAN
17. NO EXISTING OR PROPOSED DRAINS ARE LOCATED WITHIN 200 FEET OF SYSTEM OTHER THAN SPECIFIED ON PLAN

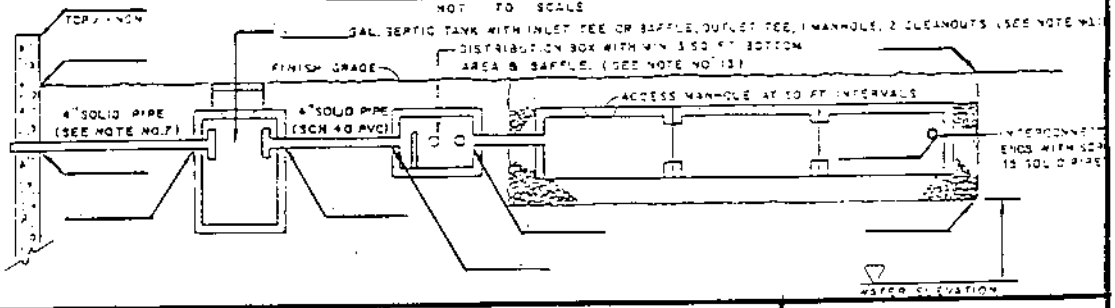
TYPICAL CHAMBER CROSS SECTION

NOT TO SCALE



TYPICAL SYSTEM PROFILE

NOT TO SCALE



PROPOSED SEPTIC SYSTEM

ALEXANDER DRIVE
PROVIDENCE, R.I.

SCALE: 1" = 20'

DATE: MARCH, 1998

OWNER:

STAMP

Sample Construction Notes with Required Dimensions and Elevations Provided

CONSTRUCTION NOTES

1. MAINTAIN INVERT ELEVATION 98.5 FOR 25 FT. AROUND SYSTEM.
2. STRIP ALL TOPSOIL & SUBSOIL TO A 0' PERIMETER AROUND SYSTEM AND BACKFILL WITH CLEAN BANKRUN GRAVEL TO ELEVATION 99.0.
3. CLEAR ALL TREES AND STUMPS WITHIN 10 FT. OF SYSTEM.
4. NO EXISTING OR PROPOSED WELLS WITHIN 200 FT. OF SYSTEM OTHER THAN SPECIFIED ON PLAN.
5. NO EXISTING OR PROPOSED SEPTIC SYSTEMS WITHIN 100 FT. OF PROPOSED WELL
6. PROPOSED WELL TO BE INSTALLED 100 FT. MINIMUM FROM ANY LEACHING FIELD.
7. INSTALL SCHEDULE 40 PVC PIPE FROM FOUNDATION TO SEPTIC TANK (4" MIN).
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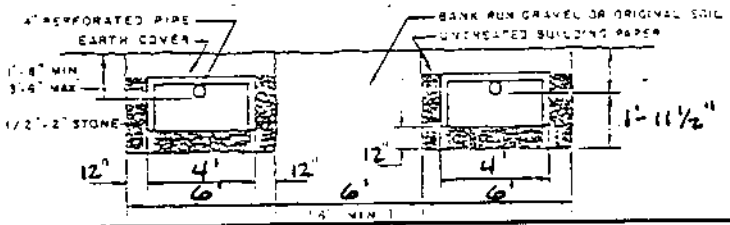
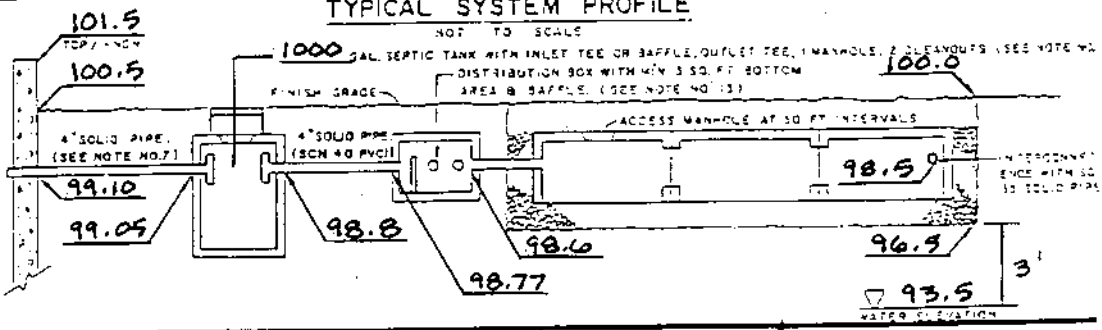
TYPICAL CHAMBER CROSS SECTION

NOT TO SCALE



TYPICAL SYSTEM PROFILE

NOT TO SCALE



PROPOSED SEPTIC SYSTEM

ALEXANDER DRIVE
PROVIDENCE, R.I.

SCALE: 1" = 20'

DATE: MARCH, 1998

OWNER:

STAMP

Class III Exam Sample Questions

Section V – Advanced Wastewater Treatment Technologies

The purpose and advantage of an aerobic treatment unit is the substantial removal and lowering of _____.

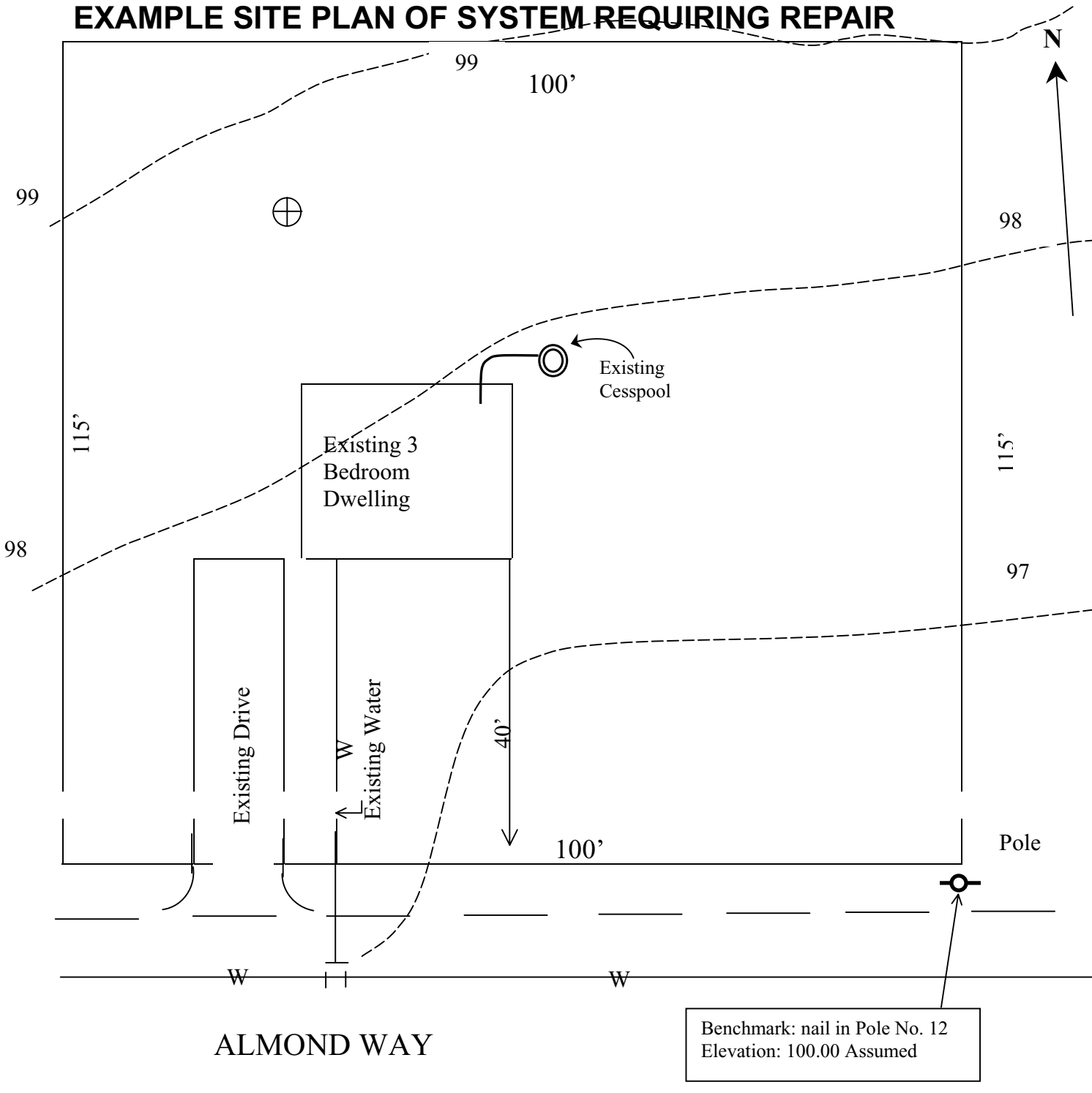
a) BOD
b) TSS
c) Pathogenic organisms
d) All of the above
e) None of the above

Section VI – Groundwater Hydrology

The ratio of voids to the volume of solid rock is referred to as _____.

a) Specific yield
b) Permeability
c) Porosity
d) None of the above

EXAMPLE SITE PLAN OF SYSTEM REQUIRING REPAIR



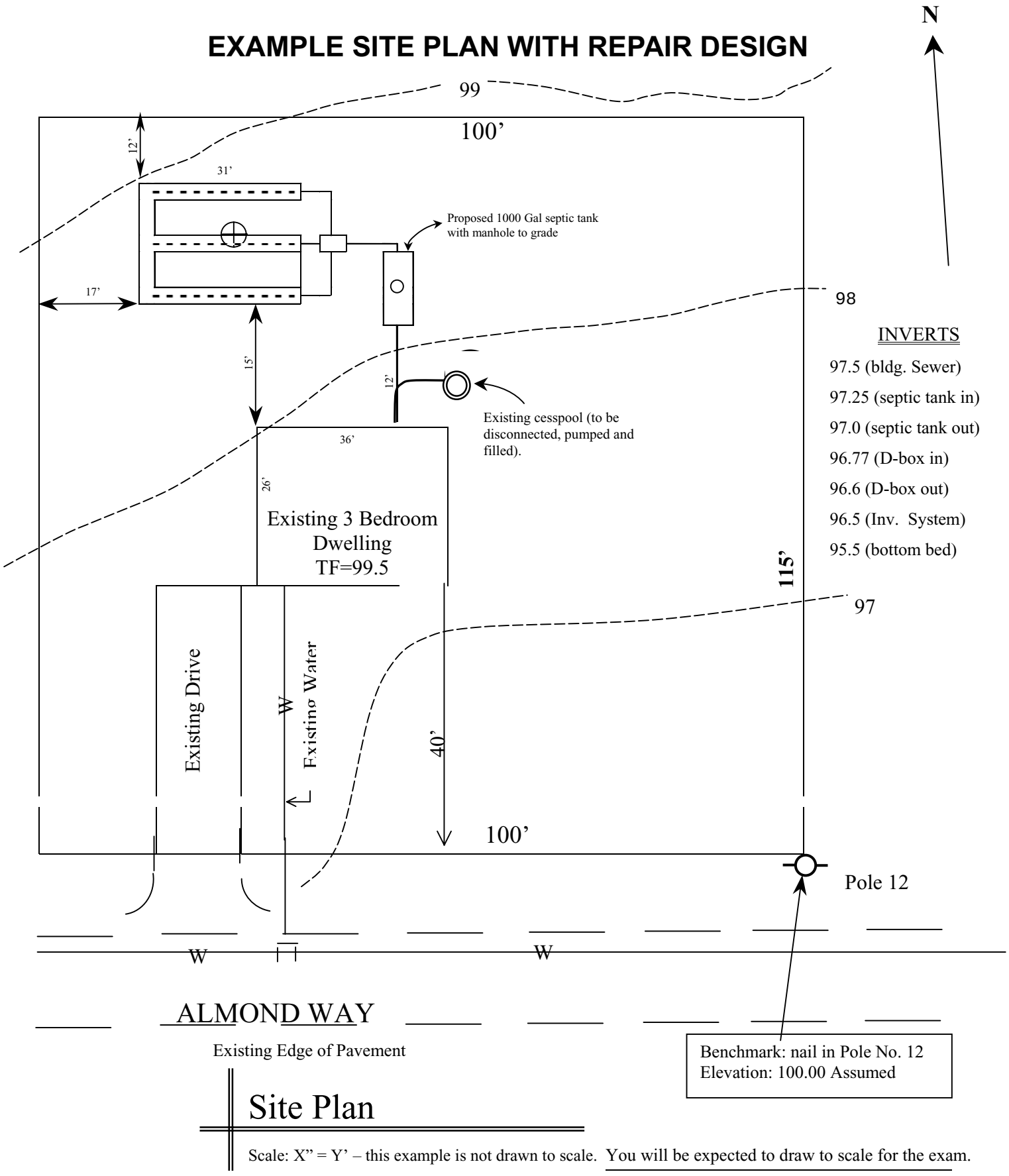
Site Plan

Scale: X” = X’ example not drawn to scale. You will be expected to draw to scale on the exam

Exist..Contour
Proposed Contour
GWT

Design Data
6’-0” Watertable
0 Min Perc Rate

EXAMPLE SITE PLAN WITH REPAIR DESIGN



INVERTS

97.5 (bldg. Sewer)

97.25 (septic tank in)

97.0 (septic tank out)

96.77 (D-box in)

96.6 (D-box out)

96.5 (Inv. System)

95.5 (bottom bed)

Site Plan

Scale: X" = Y' – this example is not drawn to scale. You will be expected to draw to scale for the exam.

Exist. Contour

Proposed Contour

GWT

12" stone below invert = 381 SF leaching area

Exam Tips

Read directions thoroughly

Know the Regulations

Budget you time!

Bring calculator, scale and pencils

Design the required system type

Design in the area of testing

Use the pink sheet (ISDS Application Submission Checklist) provided at exam

Show proposed grading

Know critical resource areas, SD 19.00 and Table 19.1 (4’ to SHWT and 6’ to impervious)

Know SD 3.05, SD 10.07, SD 11.01, SD 11.02 and SD 13.02

Study SD 25.00 - Licenses

RI DEM Class II & III ISDS Designer Examinations

2004 Study Guide

Part 3 – Design Guidance

This material has been compiled to assist you in your preparation for the Rhode Island Department of Environmental Management Class II & III ISDS Designers' Examinations. This document is intended to be utilized in conjunction with the ISDS Rules and Regulations.

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Septic SystemTreatment Basics

Collect and separate solids and grease from wastewater

Waste decomposition by physical, biological and chemical processes

Disposal of the treated water

Watewater Constituents

Microorganisms (fecal coliform and pathogens)

Nutrients (Nitrogen and phosphorus)

Organic Chemicals

Toxic Chemicals

Principles of Onsite Sewage Treatment and Disposal

Biomat – What is it?; What does it do?; How is it formed?; Where is it formed?…..

Adsorption vs. absorption

Denitrification

Function of a septic tank, d-box and leachfield

Nutrients found in septic system effluent (nitrogen and phosphorus) and their significance regarding water quality

Nitrate

Percolation test

Impervious in ISDS terms

ATUs, Sand Filters, Trickling Filters

ISDS Archive Resources

The following resources are available for researching ISDS permitting data.

- Public Access Computer at DEM (1990 – Present)
- ISDS Application Search (1990 – Present) a service of ri.gov, is available on the internet. To access this search tool from DEM home at http://www.state.ri.us/dem, select, from the bottom of the screen, the link titled "ISDS Permit Search".
- Microfilm (1970 – 1989)
- Conformed Applications (1989 – Present)
- Expired Applications (1970 – Present)
- Water Table Cards (1987 – 1992)
- Subdivision Records (1970 – Present)

Location -Minimum Distances

	Distribution Box Dosing Tank Septic Tank (ft)	Disposal Trench, Bed or Chambers (ft)	Seepage Pit (ft)	Building Sewer (ft)	Privy (f)
1. Private well (f)	75(i)	100(h)	200(h)	50(a)	50
2. Water Supply Line (pressure) (b)	10	25	25	10	25
3. Water Supply Line (Suction)	30	40	40	25	40
4. Property Line	10	10	10	10	30
5. Dwelling	5	15(c)	20	3	30
6. Surface drinking water supplies or tributaries including storm and sub-surface drains, that discharges thereto	200	200	200	200	200
7. Watercourse (e)	50	50	50	25	50
8. Subsurface drains, foundation drains, storm drains	25	25	50	25(a)	25
9. Edge of any land at a level lower than the invert of the distribution line (d)	10	25	25	25	10(d)
10. Public Drinking Water Supply Well	400	400	400	400	400

(a) Distance may be reduced when the building sewer consists of extra heavy case iron pipe or equal with tight joints.

(b) Disposal facilities shall be installed as far away possible from water supply lines. Where sewer lines must cross water supply lines, they should be constructed of durable, corrosion - resistant material with water-tight joints and either the sewer line or the water line shall be sleeved for a distance of at least twenty five feet in either direction, and whenever possible sewer lines should be laid below water supply lines at crossings. Pressurized sewer lines are not allowed to cross water supply lines.

(c) Distance may be reduced to 8 feet with a foundation slab, or in cases where the invert of the seepage system is lower than any portion of the cellar.

(d) Where fill is required and where it is necessary to fill beyond the boundary of the subject property to meet the requirements of these regulations, no approval will be granted unless the adjoining property owner(s) have given a permanent legal release (easement, etc.) filed in the land evidence records of the municipality granting such right to the owner of the applicant property. A copy of such right of access and use shall be attached to the application. Where filling is not possible, the distance may be reduced to 15 feet by the variance procedure outlined in SD 20.00, where a lined, reinforced concrete solid retaining wall is provided on no more than 2 sides. Such retaining wall shall have a proper footing, be reinforced with rods and have a plastic lining at least 6 ml thick. Designs for retaining walls must demonstrate that the wall will not alter the groundwater flow in such a way as to cause a system failure.

(e) In case of nontidal waters, the distance shall be measured from the yearly high water mark. In case of tidal waters, the distance shall be measured from the maximum water elevation during a solstice (moon) tide. Current data for the determination of solstice (moon) tide elevations has been compiled and is available upon request. Where an individual sewage disposal system will be located in the proximity of the active ocean on sites subject to erosion caused by coastal storm, the minimum setback requirement from the solstice moon tide elevation to the edge of the system shall not be less than 150 feet.

(f) Distances may be increased at the discretion of the director for the disposal of sewage for any system serving other than an individual dwelling.

(g) Any variance from the specified distances may be made after consultation between the Department of Environmental Management and the Department of Health.

SD 26.01 - Soil Category Table

SOIL CATEGORY	SOIL TEXTURE*	SOIL STRUCTURE	SOIL CONSISTENCE	RELATIVE OCCURRENCE IN RI **	ASSIGNED PERCOLATION RATE (min/inch)
1	cos, s, lcos, ls, cosl	structureless- single grain	loose	very common	10
2	vfs, fs	structureless- single grain structureless- massive	loose very friable	not common	10
3	lfs, ls, fsl, sl, l	granular, subangular blocky	very friable to friable	common	10
4	lvfs, vfsl, sil	granular, subangular blocky	very friable to friable	fairly common	15
5	lcos, ls, cosl	subangular blocky	friable	rare	10
6	lfs, ls, sl, l	structureless-massive	friable	common	10
7	fsl, vfsl, sil, si	structureless- massive	very friable or friable	common in southern RI	20
8	lcos, ls, cosl	structureless-massive	firm to very firm	quite rare	30
9	fs, sl, l, fsl, vfsl, sil, sicl	platy, structureless- massive	firm to very firm	very common	40
10	all textures	structureless- massive	extremely firm	fairly common	not allowed (impervious)

* Soil texture shall be determined with no consideration of coarse fragment modifiers.

** "Relative Occurrence in RI" is a general indicator of abundance, and it may not apply equally to every soil texture in a particular soil category.

Proper Techniques and Materials

- Bottom properly located, all setbacks per regulations, as closely as possible.
- Bottom stripped through subsoil down to parent material or C horizon.
- Bottom and sidewalls scarified
- 6” of gravel below stone if bottom material is silt loam or fine to medium sand.
- No traffic over bottom prior to spreading gravel. Gravel should be dumped at one end and spread in lifts.
- Stone must be clean – free of stone dust and between ½” and 2” in diameter
- All invert elevations must be taken from benchmark.
- Gravel and stone should be brought up 2” over distribution lines and be level across field perimeter.
- D-box must be level. Installed in undisturbed soil, if possible.
- Backfill material must be free of stones over 6” in diameter, construction debris, stumps, etc.
- No wheeled machinery should be driven over field during backfilling.

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

FIELD GUIDANCE FOR ISDS INSTALLATIONS

February 1999

The following guidelines for field tolerances need to be used by licensed ISDS designers to determinine if an ISDS is installed in compliance with approved plans. The Department recognizes that slight deviations from approved plans will not have a measurable effect on system performance. The Department recognizes that certain field changes, such as foundation footprint and final grading, are often due to the specifications of a homebuyer who is not involved in the project at inception. The purpose of this document is to set general guidelines on allowable changes in the field that differ from the original design. This document will also clarify when Department approval, as-built plans, and/or a redesign will be required. All deviations from approved plans must be noted on the Certificate of Construction (COC).

1. TOLERANCES

These deviations from approved plans **will not** require pre-approval of the Department

- One (1) foot on any minimum horizontal distance shown in SD. 3.05 and Table 19.1.
- Well, waterline, or leachfield is moved up to 5 feet from the original location, but it is in compliance with the minimum distances shown in SD. 3.05 and Table 19.1, and with the tolerances specified above.
- The invert of the distribution pipe or the bottom of the stone elevation is moved up to 3 inches vertically.
- A 10% deviation on all vertical and horizontal separation distances listed in SD. 11.02.
- The building sewer pitch is between 1% and 3%.

Note: VARIANCES - Any critical distance approved by variance must be adhered to strictly.

If conditions are encountered during construction which indicate that the system cannot be installed or is not installed in accordance with the permit and the above tolerances, the designer
shall notify the Director as soon as possible, but no later than 24 hours after discovery.

2. AS-BUILTS - $30.00 fee required for as-built submittals (except for repair applications-no fee required) and 4 copies of the As-Built drawings.

As-Built plans may be required when changes in the field exceed horizontal and vertical tolerance limits but still comply with the standards in the ISDS Rules and Regulations. The designer shall notify the Department when changes exceed acceptable tolerances. The designer shall certify these changes on the COC and by submitting as-built plans within 10 business days after the ISDS is installed.

The following are instances where the Department may require that As-Built drawings:

- The leachfield has moved up to 10 feet from the location on the approved plan.
- Orientation or location of the building served by the ISDS is changed so that up to 25% of the footprint is outside the footprint on the approved plan.
- The well, waterline, or leachfield has moved up to 10 feet from the approved plan.

3. <u>REDESIGN</u> - $80.00 fee, 4 copies of the redesigned plans, and a new application form must be submitted.

Designers are required to submit redesigned plans when a well, foundation, wall, tank, waterline, leachfield, or other structure is placed in a location that is significantly different than indicated on the approved permit . If a redesign is required, the designer must stop construction
of the ISDS and take measures to protect all completed work to date.

The following are instances where the Department may require redesigned plans:

- The leachfield is moved more than 3 inches vertically or more than 10 feet horizontally from the approved plan.
- Orientation or location of the building served by the ISDS is changed so that more than
  25% of the footprint is outside the footprint on the approved plan.
- The well or waterline is moved more than 10 feet.
- The invert of the distribution pipe or the bottom of the stone elevation has moved more than 3 inches vertically from the approved plan.

Septic System Failure

Excerpt from ISDS Regulations Definitions Section

FAILED SYSTEM - The term, "failed system," shall be held to mean any sewage disposal system that does not adequately treat and dispose of sewage so as to create a public or private nuisance or threat to public health and/or environmental quality, as evidenced by, but not limited to, one or more of the following conditions:

(1) Failure to accept sanitary sewage into the building sewer;
(2) Discharge of sanitary sewage to a basement, subsurface drain, surface drain or surface water unless expressly permitted by the Department.
(3) Sanitary sewage rising to the surface of the ground over or near any part of an individual sewage disposal system or seeping downgradient from the absorption area at any change in grade, bank or road cut.
(4) Any deterioration or damage to any individual sewage disposal system that would preclude adequate treatment and disposal of wastewater. (For example, contact between the bottom of the ISDS and the watertable.)

Two Types of Septic System Failure

Treatment failure - A system which is not adequately treating effluent (destruction, removal/reduction of pathogens: bacteria and viruses and reduction of nutrients: nitrogen and phosphorous).

Hydraulic failure – A system fails to accept all the wastewater being delivered to it. This may be evidenced by effluent backing-up into the home or effluent on the surface in the yard.

Possible Causes of System Failure:

- leaking fixtures in the home,
- system undersized (tank and or leachfield)
- tank not watertight (water seeping into tank)
- baffle not in tact or no outlet tee (allowing solids to carry over to the leachfiled)
- d-box not level (effluent not distributed evenly over entire field)
- system in groundwater
- dirty stone
- crushed pipe
- leach field clogged

Signs of ISDS Failure

- Discharge to the surface of the ground.
- Lush growth over portion of the lawn.
- Sewage backup inside the house.
- Sewage odor in house or yard.

Where to Investigate

- Inlet, outlet hatches, if septic tank in use.
- Run water; insure flow is entering and exiting tank.
- Check for buildup of solids; is outlet tee in place?
- Water test sewer line between tank and D-box.

Application for Repair – excerpt from ISDS Regulations SD 2.01

(d) **Application for Repair** - An application for a repair of any individual sewage disposal system, or any component thereof, shall be made when an existing system or component has failed, as defined by SD 1.00.

(1) All plans and specifications for a repair to an ISDS shall be prepared by a person licensed as a Class I, II or III designer in accordance with SD 25.00. **The applicant is not required to have a site evaluation report prepared unless the Department specifies otherwise**. The Director reserves the right to require that the plans and specifications for a repair be prepared by a Class II or Class III licensed designer..

(2) **An application for repair shall not propose any construction, building renovation or change of use of a structure pursuant to SD 2.00.**

(3) An application for repair shall not propose any increase in the original design flow of the system. Sewage flows shall be determined in conformance with SD 3.00.

(4) **The approval of an application for repair shall not authorize any building renovation of any structure.**

(5) Applicants shall meet the requirements of these regulations to the greatest extent possible. If necessary, certain requirements under these regulations may be relaxed at the discretion of the Director, provided that such modification is consistent with the protection of the public health and the environment. In reviewing any request for relaxation of these regulations, the protection of the public health and the environment shall be given priority over all other considerations.

Use of Existing System in Design of Repair

- Building sewer should be replaced if not up to code.
- Steel tanks or undersized concrete tanks should be replaced, if possible.
- Insure existing tank has outlet tee.
- Old fields should be abandoned if failed.
- Portions of existing field may be used if field found to be only partially failed. Failed trenches can be disconnected by use of speed levelers or by capping off distribution lines inside d-box.

Methods for Water Table Determination for ISDS Repairs

- Test Hole
- Previous Application
- Knowledge of Area
- Nearby Dug Well
- Other: Wet Season

ISDS REPAIR SUBMISSION REQUIREMENTS

Application for ISDS Repair:
In accordance with Section SD 2.02, the following repair submission requirements are established for residential uses disposing of not more than 900 gallons of sewage per day.

Application Form:
All applications for the approval of plans for ISDS repair shall be made on form(s) provided by the Director.

Basic Design Data/Plan Requirements:
All applications for ISDS repairs shall include basic design data and a drawing detailing the property and/or pertinent portion thereof showing the size and location of the proposed ISDS. All applicable site features, including but not necessarily limited to, buildings, fences, driveways, trees, and pools shall be shown. It is essential that measured distances be used to locate all proposed improvements and existing conditions. Information to be provided on the plan shall include, but not be limited to, the following:

1. Spot elevations over the proposed leachfield. If filling is needed to meet fill perimeter requirements, provide existing and proposed spot grades to detail the filling;
2. A fixed benchmark within 50 feet of the proposed ISDS that will not be disturbed during construction;
3. Invert elevation schedule;
4. Measured distances to site features;
5. Location and type of existing ISDS. If previously approved, provide old application number;
6. Location of any test holes and/or percolation test holes;
7. The location and/or distance of all water lines, including public and private water mains and/or service lines. In instances where it is unavoidable that the proposed ISDS be within 25 feet of a waterline, approval must be obtained by the appropriate public water supply agency and letter sent in with application). Waterlines are to be located and marked by the appropriate public water supply agency prior to application submission;
8. The location and/or distance of any and all drains within 50 feet of the proposed ISDS;
9. The location and/or distance of any private drinking water wells within 200 feet of the proposed ISDS;
10. The location and/or distance of any public drinking water wells within 400 feet of the proposed ISDS;
11. The location and/or distance of any wetlands within 200 feet of the proposed ISDS;
12. The location and/or distance of any drinking water supplies, including any tributaries or storm/subsurface drains discharging directly into the drinking water supply, within 200 feet of the proposed ISDS;
13. For proposed ISDS repairs involving pumps, submit at a minimum: pump chamber volume, dose calculations, and pump sizing graph (See ISDS Design Criteria sheet);
14. For proposed ISDS repairs requiring structural retaining walls, a professional engineer must design the wall (Note: In general, landscape timbers and lot curbing are not considered structural retaining walls).

The Director reserves the right to require other information deemed necessary by the Department to fulfill its obligations in accordance with applicable statutes and regulations, on a case by case basis. SD 3.05

ISDS Design Criteria

ISDS DESIGN CRITERIA

I. PUMP CHAMBER VOLUME:

1. 24" diameter round chamber:
   - 23.5 gallons per foot or 2 gallons per inch.
2. 36" diameter round chamber:
   - 52.87gallons per foot of chamber or 4.41 gallons per inch.
3. 48" diameter round chamber:
   - 94 gallons per foot of chamber or 7.83 gallons per inch.
4. 48" square chamber:
   - 119.68 gallons per foot of chamber or 10 gallons per inch.

II. DOSE PER FIELD TYPE:

1. **Flow diffusors:** Use 1" dose over bottom area of 4' X 8' = 2.66ft3 or **20 gallons** per unit.
2. **Galleys:** Use 2" dose over bottom area of 4' X 4'. 2.66 ft3 or **20 gallons per unit.**
3. **Trenches:** Volume of leaching line = 0.652 gallons/foot. Use 60% - 75% of volume or 0.4 – 0.489 gallons/foot.
4. **Eljens:** Use 0.4 – 0.489 gallons/foot of leaching line or 1.6 – 2 gallons per unit.
5. **Infiltrators:**

III. MINIMUM LEACHING AREA:

Perc. Rate (mpi)	Max. application rate (Gals/ft3/day)	Ft3/bedroom
5	1.20	125
10	0.91	165
15	0.79	190
20	0.68	220
25	0.63	240
30	0.60	250
40	0.52	290

IV. EFFECTIVE LEACHING AREA:

a. Trenches

Depth of stone Below invert	Area allowed per linear foot of trench (ft2/ft) (36" wide trench)
0.5	3.0
1.0	3.7
1.5	4.2
2.0	4.7
2.5	5.2
3.0	5.7
3.5	6.2

b. Galleys

	END UNITS			INTERIOR UNITS		
Stone Depth	U = 12"	U = 18"	U = 24"	U = 12"	U = 18"	U = 24"
A = 12"	98	106	114	58	62	66
A = 18"	116	125	134	62	66	70
A = 24"	133	143	153	66	70	74

c. Flow Diffusors

	END UNITS			INTERIOR UNITS		
Stone Depth	U = 12"	U = 18"	U = 24"	U = 12"	U = 18"	U = 24"
A = 12"	78	90	102	64	72	80
A = 18"						
A = 24"	136			80		

ISDS Design Applications and Installations
Common Permitting Errors, Omissions and Problems

Pre-Approval

- ⁄# Design element missing on plan (eg. septic tank)
- ⁄# Missing signature
- ⁄# Items(s) checked off on Pink Sheet are not provided or completed, Pink Sheet error or Pink Sheet not provided or completed
- ⁄# 25.05 (b)(2) General incompetence displayed on plans that have been submitted
- ⁄# Plan errors
- ⁄# Field incorrectly sized
- ⁄# Omission of essential data
- ⁄# Some aspect of setback regulation not met; variance required but not divulged
- ⁄# Expired or incorrect field data
- ⁄# Design not in accordance with subdivision approval
- ⁄# Trench configuration or distances between trenches incorrect or not clear
- ⁄# Application not completed

Post Approval

- ⁄# Designer not calling in 24 hour start of construction notice
- ⁄# COC not submitted within 5 days or not at all
- ⁄# Designers missing deficiencies during their inspections of septic systems.
- ⁄# Required bottom inspections not being called in.
- ⁄# Cover inspections not being called in when required
- ⁄# Installation records not being kept or inadequate
- ⁄# Installation or design change not reported to Department

Installers

- ⁄# Begins construction without designer involvement
- ⁄# Installer does not cooperate with designer to allow designer to do his/her part of job
- ⁄# Installer not following design plan
- ⁄# Deficiencies discovered by our inspectors during spot inspections due to installer mistake

Responsibilities of Licensed ISDS Designers Hired by a Homeowner in Response to Direction from DEM Office of Compliance & Inspection (OCI)

1) When contacted by a property owner regarding inspection and/or repair of a system, make sure to ask if they have received any letters from DEM.

2) **If the answer is yes**, make sure you read the letter so you understand what the issue is.

3) Call OC & I:
   a. Advise them that the property owner has retained you to address the issue(s) in the letter, and
   b. Provide them some idea of what you will be doing (time frame, approach, etc.).

4) Most of the notices require that an evaluation of the system be performed by a licensed designer and a report submitted to OC & I. The report, in addition to date, time and weather conditions, should include the following:
   (1) What was the cause of the system failure the OCI inspector observed and what was done to address that problem, if anything.
   (2) Was the system functioning properly on the date of your inspection.
   (3) If not, what is the cause of the system failure and what do you recommend to fix the problem.
   (4) If you establish that the system is functioning properly, how did you determine this:
      - Did you do a flow through test,
      - Pull the covers of the tank, d-box, etc.,
      - What were the levels in the tank, d-box, etc.

IMPORTANT!!!

You are the licensed professional, the expert; you are expected to apply your experience and knowledge to evaluate the situation and prepare a comprehensive report for submission to OCI which supports your findings. At the time of your inspection, record for inclusion in your report, date, time, weather, all inspection activity conducted, observations and information provided by the homeowner.

Inspection of Septic Systems

Information on septic system function and procedures for conducting inspections of septic systems is available in the DEM publication "SEPTIC SYSTEM CHECKUP: THE RHODE ISLAND HANDBOOK FOR INSPECTION". This document is available on the DEM website. The Universal Resource Locator (URL) for this is: http://www.state.ri.us/dem/pubs/regs/regs/water/isdsbook.pdf

You may navigate to this document as follows: from DEM home (http://www.state.ri.us/dem), select "Programs", then "ISDS", and then from the right side of the screen, select the link "Septic System Checkup

RI DEM Class II & III ISDS Designer Examination

2004 Study Guide

Part 4 – ISDS Forms

This material has been compiled to assist you in your preparation for the Rhode Island Department of Environmental Management Class II & III ISDS Designers' Examinations. This document is intended to be utilized in conjunction with the ISDS Rules and Regulations.

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DEM ISDS Design Application

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
INDIVIDUAL SEWAGE DISPOSAL SYSTEM APPLICATION

FOR DEM USE ONLY

APPLICATION No.__________ DATE RECEIVED___/___/___ AMOUNT RECEIVED $________ CHECK #______ COST CODE ______

TYPE OF APPLICATION

☐ NEW BUILDING CONSTRUCTION
☐ ALTERATION
☐ REPAIR
☐ TRANSFER

CHECK IF APPLICABLE

☐ I/A TECHNOLOGY
TYPE OF SYSTEM __________
☐ VARIANCE

OWNER INFORMATION

LAST NAME ______ FIRST NAME ______ M.I. ______

NO. STREET ______ CITY/TOWN ______ ZIP CODE ______

SITE INFORMATION

NO. STREET ______ CITY/TOWN ______ POLE # ______

PLAT NUMBER__________ LOT NUMBER__________ SUBDIVISION LOT NUMBER_______

LOT SIZE __________ SQUARE FEET

SUBDIVISION NAME __________

PRELIMINARY SUBDIVISION SUITABILITY # __________

DEM APPLICATION HISTORY

PREVIOUS WATER TABLE/ISDS # ☐YES ☐NO APPLICATION # __________

DEPTH TO VERIFIED WATER TABLE ______ How Determined __________

TEST HOLE #____ DATE EXCAVATED___/___/___ WETLANDS within 200' of ISDS ☐YES ☐NO

WETLAND PERMIT ☐YES ☐NO PERMIT#________ DATE OF APPROVAL___/___/___

Groundwater Quality Certification attached? ☐YES ☐NO (Required for a system ≥ 10,000 gpd.)

DESIGN INFORMATION

BUILDING USE: ☐Residential ☐Commercial__________
☐Other__________

WATER SUPPLY: ☐public water ☐public well ☐private well

OF DESIGN UNITS__________

UNIT DESIGN FLOW ______ gallons per ______ (unit) TOTAL DAILY FLOW __________ gallons

TANK SIZE __________ gallons DESIGN PERCOLATION RATE __________ minutes/inch

MINIMUM REQUIRED LEACHFIELD AREA __________ square feet

LEACHFIELD TYPE __________

TOTAL AREA OF LEACHFIELD PROVIDED__________ SQUARE FEET

CERTIFICATION

I, __________ (print), the undersigned licensed ISDS designer, certify that I prepared this application and accompanying forms, submittals, plans and sketches in accordance with the rules and regulations of the Rhode Island Department of Environmental Management pertaining to individual sewage disposal systems and that all the information provided on this application and accompanying forms, submittals, plans and sketches is true and accurate.

Signature of Designer __________

Designer License Number __________ Phone # __________

Business/Company Name__________

I certify that: a) I am the owner of the property indicated under site information on this application, b) I will hire a licensed ISDS installer to install the system proposed herein, c) the system will be installed in strict accordance with this application, d) I will hire and retain the licensed ISDS designer of record to witness and inspect the installation of the system, e) I assume all responsibility for the truth and accuracy of this application and all liability and responsibility for any improper installations of the system on this site and agree to hold the Department of Environmental Management harmless from any and all claims relating whatsoever to the system.

Owner(s) Signature__________ Phone Number __________

PERMIT APPROVAL SECTION
TO BE COMPLETED BY A DEM OFFICIAL; DO NOT WRITE BELOW THIS LINE

Based upon the representations of the owner, and the owner's agents, including the representations of the owner's licensed ISDS designer, this application for an individual sewage disposal system is hereby approved based upon the truth and accuracy of all information submitted. The Department of Environmental Management assumes no responsibility or liability for the future safe operation or maintenance of the aforesaid system, of the fitness or suitability of this system to this site, nor does it assume any responsibility for the accuracy and truth of the owner's, or the owner's agents' representations. This approval is subject to future suspension and revocation in the event that subsequent examination reveals any data indicated on any application, form, submittal, plan or sketch to be incorrect, or not in compliance with the regulations or any condition at the site are such that the approved design is not in accordance with the regulations, or in the event that the system discharges sewage on or to the ground surface, or on or to any watercourse or, fails to operate satisfactorily in any other manner.

IMPORTANT: Please note the circled additional terms of approval

A. Designer of record must witness and inspect all stages of construction and must submit a certificate of construction in accordance with SD27.00.
B. Designer of record must contact DEM 24 hours before start of construction.
C. Bottom of leaching area excavation must be inspected by the DEM prior to placement of any gravel or stone.
D. System installation must be inspected by DEM prior to covering any component of the the system with backfill.
E. Approved per variance, decision dated __________, all requirements, conditions and stipulations of which shall be strictly adhered to.
F. I/A Technology: additional specific installation, operation, or maintenance requirements may apply (see DEM I/A Technology certification for this system type).
G. Proper erosion and sedimentation controls must be installed prior to the start of construction.
H. Other

Signature of Department of Environmental Management Official	Date of Approval	Date of Expiration

DEM

SEE INSTRUCTIONS ON REVERSE SIDE

DEM ISDS Inspection Report

Rhode Island Department of Environmental Management

Individual Sewage Disposal System Section

INSPECTION REPORT

APPLICATION NUMBER:

STREET:

INSPECTOR:

CITY/TOWN:

INSPECTION DATE:

PLAT/LOT: | POLE NO:

ARRIVAL TIME:

ISDS INSTALLER:

WEATHER CONDITIONS:

PHONE NO: INSPECTION NUMBER:

TYPE OF INSPECTION:

FINDINGS/COMMENTS

RESULTS OF INSPECTION/ACTION REQUIRED

- ❑ Bottom Bed OK -- Construct system and call for cover inspection
- ❑ (RFA) Address items listed or checked and call for a re-inspection
- ❑ (RFA) Correct items listed
- ❑ (RFA) Correct items listed
- ❑ Cover System
- ❑ (COC) Submit certificate of construction
- ❑ (RFAD) STOP CONSTRUCTION. Contact designer. DO NOT CONTINUE. Items listed are too complex for a simple resolution
- ❑ (ASB) Designer Must Submit As Built Plans
- ❑ (RPREQ) Submit Revised Plans
- ❑ (S0S) Designer's Supervision and Statement Required
- ❑ (S0S) Designer's Supervision and Statement Required
- ❑ (DRYVER) Dry Season Verified
- ❑ (DRYUNA) Dry Season Unacceptable
- ❑ (FEE) If this item is checked, a $50 fee is required before re-inspection. Send copy of this inspection form with the check

Signature of Inspector(s) _____

INSPECT FRM REV. 9/96

INSTALLER'S COPY

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF WATER RESOURCES
PERMITTING SECTION
INDIVIDUAL SEWAGE DISPOSAL SYSTEMS PROGRAM

DESIGNER'S CERTIFICATE OF CONSTRUCTION FOR ISDS

Permit No. _____

I, _____, as the designer of record for the ISDS installation located at (Street)_____ in the City or Town of _____ hereby certify that the installation of the ISDS was performed by the installer named below, and to the best of my information, knowledge and belief, was witnessed and inspected in accordance with RIDEM/ISDS Rules and Regulations, and that, in my professional opinion, the installation of the ISDS conforms with the plans, specifications, applicable statutes, regulations, and construction tolerances as approved by the Director of the Rhode Island Department of Environmental Management. I further certify that I have documented the installation in accordance with RIDEM/ISDS Rules and Regulations. This certification is effective as of (date): _____

The septic tank, D-Box (if any) and leach field are located as set forth below:

Installer's Name _____ License No._____

Designer License No. D- _____

Designer's Signature _____ Date Signed _____

Designer Request of Change (DROC) Approval Date(s) _____

DESIGNER: PLEASE RETAIN GREEN COPY FOR YOUR RECORDS

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF WATER RESOURCES
PERMITTING SECTION
INDIVIDUAL SEWAGE DISPOSAL SYSTEMS PROGRAM

AFFIDAVIT TO REPLACE DESIGNER OF RECORD

I _____ said owner(s) of property, ISDS permit number
(print name)

_____, do hereby request authorization to have the replacement designer

_____ witness and inspect the installation of
(designer name and license number)

the ISDS on said property. I am petitioning the Department for this request based on the following reason(s):

CHECK APPROPRIATE ITEM(S):

1) _____ The original designer of the system is incapable of witnessing and inspecting the system because he/she is:
_____Deceased
_____Physically Incapacitated
_____No Longer Licensed
_____Other_____

2) _____ I, the property owner, contracted with a certain business entity for design services. The original designer who prepared the ISDS design is no longer employed by that business entity, and the property owner is replacing the original designer with another designer employed by that business entity.

Owner(s) signature: _____ Date: _____
(Owner must be the same person as permitee)

I, the replacement designer, have a designer's license in the appropriate license class required by the regulations to design the system prepared by the original designer of said ISDS. I take full responsibility for the design and installation of the system in accordance with all ISDS Rules and Regulations.

Replacement designer's signature: _____ Date: _____

FOR OFFICE USE ONLY

DECISION Approved Ã Denied Ã

Comments_____
_____
_____

Signature of Authorized Agent_____ Date_____

9/98